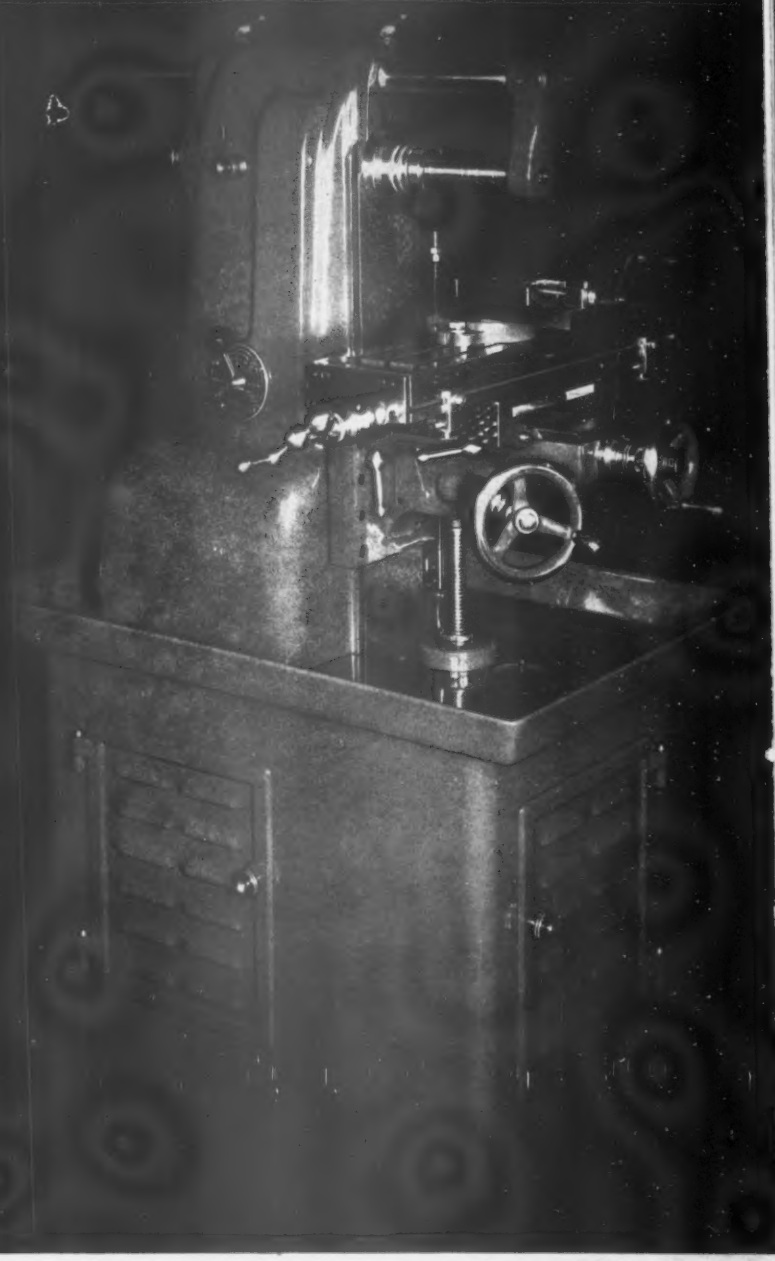
Special TOOLING for DEFENSE Issue
APRIL, 1941

The TOOL ENGINEER

MACHINERY • PRODUCTION • TOOLS

HARDINGE
Precision MILLING MACHINES
are Preferred
BECAUSE OF
PERFORMANCE



Day and night Hardinge High Speed Precision Milling Machines are meeting the definite demands for which they were designed.

Their performance is being proven NOW. The accuracy, ruggedness, and ease of operation make them preferred for exacting milling operations.

This machine, along with the other Hardinge Precision Machine Tools, is verifying the logic of using the proper size machine for the work.

HARDINGE BROTHERS, Inc.
ELMIRA, NEW YORK

ACCURACY...

Another kind of P&W accuracy . . . this time not metal finishing, but *accuracy* in the remarkable wiring of the Keller Machine's electrical brain. By now, the assembly pictured here is turning out precision dies or experimental parts for American defense.

Photograph by Kessel

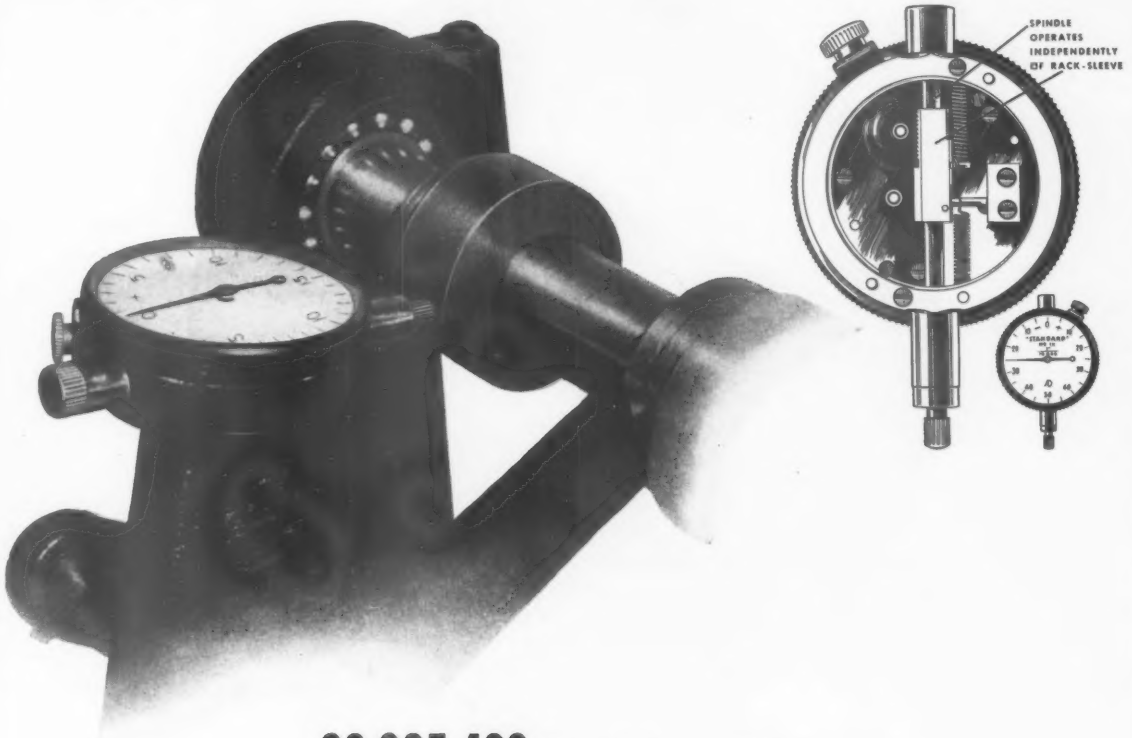
breeds volume production

OPEN secret among tool engineers and production men is the truth that *given basic accuracy in jigs, fixtures, and gages, virtually unlimited production can roll off American assembly lines in record-breaking time.*

Over 3200 P&W craftsmen now keep West Hartford humming 24 hours a day, building this basic accuracy into machines that make machines. Engineers and tool-makers in American industry use P&W accuracy for fast expansion of top-grade production — specializing new workers, cutting waste, increasing output.

PRATT & WHITNEY

Division **Niles-Bement-Pond Company • West Hartford, Connecticut, U. S. A.**



22,035,466 hard impacts . . . .
and not a trace of injury!

● The above picture is a close-up of our impact-testing machine for Dial Indicators. In the course of routine inspection, Indicators are taken from production lots and tested for shock resistance.

● One Dial Indicator, picked at random, was subjected to over 22 million blows during 2700 consecutive hours. These blows were far heavier and sharper than the spindle is likely to suffer anywhere in actual service!

● At the end of this test the Indicator was thoroughly inspected. Its accuracy was unimpaired, and no damage or appreciable wear could be found except at the contact point. The test could have been safely continued.

● This brutal punishment by millions of hard shocks did not affect the measuring mechanism, thanks to our Shockproof Design.

Standard Gage Company, Inc.
80 Parker Avenue, Poughkeepsie, N. Y.

STANDARD *Gages*

A-1544

Tool Engineers *at the Show didn't pull their Punches!*

Yes, sir, the Tool Engineers at the Show, certainly made it very clear that Holo-Krome FIBRO FORGED Screws — the Completely Cold Forged Screws—have been and are giving them Unfailing Performance.

They substantiated their claims with explanations and even drawings of the actual applications — that formerly were problems. Since specifying and Standardizing on Holo-Krome they get what they want —Guaranteed, Unfailing Performance.

Socket Screw Standards Available—Write Dept. 77

HK HOLO-KROME

fibro forged

THE HOLO-KROME SCREW CORP. **SOCKET SCREWS** HARTFORD, CONN. U.S.A.

THE TOOL ENGINEER

"America in the Making"

CONTENTS OF VOLUME X NUMBER 4

April, 1941

TOOLING FOR DEFENSE

Editorial Preface 41

Statistical Background 45

Part I: Peace and War 46

- Industry and National Defense 48
  by E. M. Sims
- The FBI and National Defense 55
  by L. R. Pennington

Part II: Aircraft Requirements 58

- Fuselage Production 60
  by Louis Biehler
- Aircraft Engine Design 63
  by C. W. Van Ranst

Part III: Ordnance Requirements 66

- Army Ordnance Planning 68
  by General G. M. Barnes
- Naval Ordnance Planning 72
  by Joseph A. Davies

Part IV: Educational Requirements 78

- How Connecticut Solved the Training Problem 80
  by Carl A. Gray
- How One Plant Solved the Training Problem 94
  by Bartley Whiteside

FEATURES

Production Perspectives 117

It's New 121

New Literature 130

Handy Andy Says 134

A. S. T. E. Doings 140
by Irwin F. Holland

The Passing Parade 151

NEWS

New Officers for A. S. T. E. 110

1941 Show Breaks Records 111

Production Perspectives 117

April Meetings 158

Advertisers' Index 160

Member

ECA

Controlled Circulation Audit, Inc.

NBP ASSOCIATION

National Business Papers Assn.

•

ROY T. BRAMSON
Editor and Publisher

J. A. ASHBURN
Associate Editor

R. E. GILLESPIE
Business Manager

B. C. YOHE
Circulation Manager

Published by
THE BRAMSON PUBLISHING CO.
2842 W. Grand Boulevard
DETROIT, MICHIGAN
MAdison 7553

ADVERTISING OFFICES

New York City
A. M. Willcox
420 Lexington Avenue
Lexington 2-4816

Chicago, Illinois
Dwight H. Early
100 N. LaSalle Street
CENtral 4158

Providence, R. I.
Herman T. Pierik
4 Weybosset Street
GAspee 1568

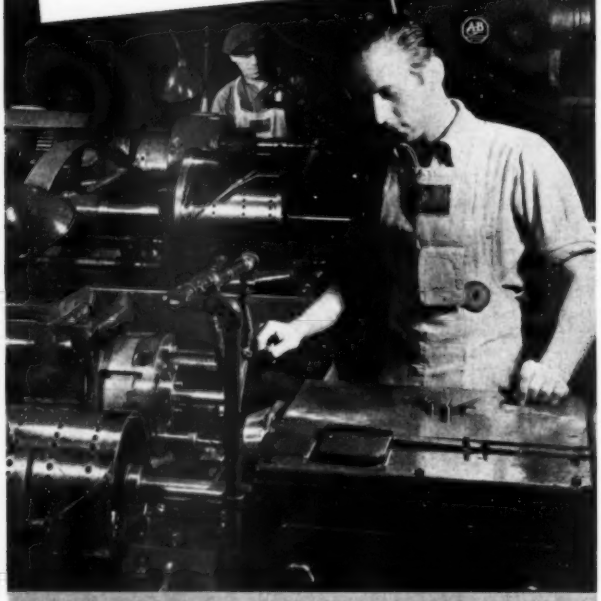
Detroit, Michigan
Thomas J. Orlando
2842 W. Grand Blvd.
MAdison 7553

San Francisco, Calif.
Robert W. Walker
68 Post Street
SUtter 6706

Los Angeles, Calif.
Wentworth Green
1709 West 8th St.
EXposition 8292

THE TOOL ENGINEER. Copyright 1941 by The Bramson Publishing Company. Published the first Thursday of each month. The official publication of the American Society of Tool Engineers, Incorporated. Acceptance under the Act of June 5, 1934, at Saint Joseph, Michigan, authorized December 18, 1940. Printed in the United States of America.

CURTISS-WRIGHT JUMPS PARTS PRODUCTION 300% WITH CLEVELAND MODEL AA



♦ Certain parts made in the Buffalo plant of Curtiss Aeroplane Division, Curtiss-Wright Corporation, had been produced on hand-screw machines prior to installation of several Cleveland *Single Spindle* Automatics, Model AA. Today, these same parts produced in small lots and short runs are averaging a production increase of about 300%! Model AA Clevelands are so flexible and fast, so accessible and easily tooled up, that records are set almost as soon as they are put to work. ● Previous long experience with Cleveland Model A machines established the responsibility and integrity of Cleveland *Single Spindle* Automatics in this plant. Stream-lined, completely housed-in, these new Clevelands match today's production needs with adequate speed and accuracy for every job assigned to them. Ask for further particulars.

THE CLEVELAND AUTOMATIC MACHINE CO. • Cleveland, Ohio

Sales Offices:

NEW YORK, 50 Church Street • DETROIT, 2842 Grand Boulevard
CHICAGO, 565 W. Washington St. • CINCINNATI, 314 American Bldg.

CLEVELAND *Single Spindle* AUTOMATICS

Frank W. Curtis, *President*

AMERICAN SOCIETY OF TOOL ENGINEERS

2567 W. GRAND BLVD., DETROIT, MICH.

Ford R. Lamb, *Executive-Secretary*

O. W. Winter, *1st Vice-President* — **F. R. Crone, *Treasurer***
Ray H. Morris, *2nd Vice-President* — **Clyde L. Hause, *Secretary***

BOARD OF DIRECTORS—1940-41

Charles T. Allen
E. B. Barber
Joseph L. Berry
Louis Biehler
J. R. Blank
C. V. Briner
D. D. Burnside
Raymond A. Cole
Clarence E. Cook
Frank R. Crone
Frank W. Curtis
A. H. d'Arcambal
John C. Dense
E. W. Dickett
F. J. Diehl
Floyd E. Doty, Jr.
Thomas P. Orchard
Floyd W. Eaton
A. D. Forbes
W. T. Forde
Paul W. Frankfurter, Sr.
W. J. Frederick
R. J. Freter
George Goodwin
W. T. Gray
Clyde L. Hause
Harold L. Heywood
H. D. Hiatt
Carl W. Horack
George J. Keller
Nils H. Lou
Kenneth W. Lund
Joseph B. Morganthall
W. B. Pierce
Lorence E. Rennell
Arnold Thompson
James R. Weaver
Ray Wentzler
George W. Wise
Frederic L. Woodcock
Adolph Zaborowski

NATIONAL COMMITTEE CHAIRMEN

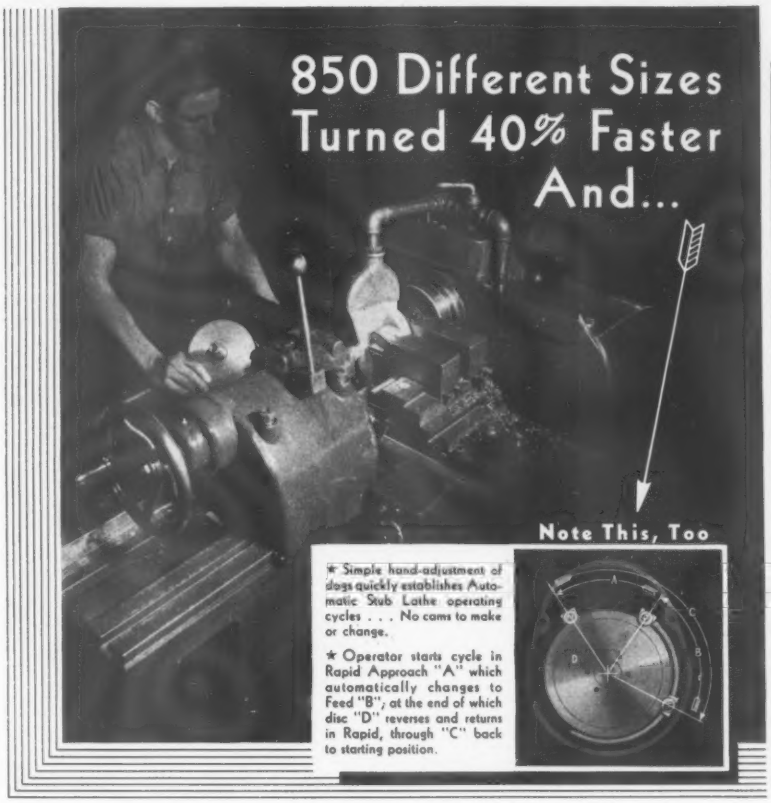
Industrial Relations — W. F. Wagner
New Chapters — R. T. Bramson
Membership — C. B. Cole
Standards — E. W. Ernest
Editorial — I. F. Holland
Publicity — Louis L. Weber
Historian — O. B. Jones
Constitution and By-Laws — R. M. Lippard
Educational — H. D. Hall

CHAPTER CHAIRMEN AND SECRETARIES 1940-41

Baltimore: Nils H. Lou, Chairman; Carl A. Larsen, Secretary, c/o Glenn L. Martin Co., Baltimore, Maryland.
Binghamton: W. T. Forde, Chairman; Don Goettcheus, Secretary, 16 College Street, Binghamton, New York.
Boston: A. D. Forbes, Chairman; W. W. Young, Secretary, 238 Main Street, Cambridge, Mass.
Buffalo: George J. Keller, Chairman; Alfred Cotesworth, Secretary, Columbus-McKinnon Chain Corp., Buffalo, New York.
California Chapter at Los Angeles: Louis Biehler, Chairman; Merton W. Seavey, Secretary, Lockheed Aircraft Corporation, Los Angeles, California.
Chicago: Clarence E. Cook, Chairman; Fred J. Schmitt, Secretary, D. A. Stuart Oil Co., Chicago, Ill.
Cincinnati: W. J. Frederick, Chairman; W. D. Averill, Secretary, Sales Engineer, Cincinnati Milling Machine and Grinder Company, Cincinnati, Ohio.
Cleveland: C. V. Briner, Chairman; Wm. Reiff, Jr., Secretary, Cleveland Duplex Machinery Co., Cleveland, Ohio.
Columbus: R. J. Freter, Chairman; S. J. Matchett, Jr., Secretary, 755 Roosevelt Ave., Bexley, Ohio.
Dayton: George Goodwin, Chairman; Howard McMillen, Secretary, Aeroproducts Division, G.M.C., Dayton, Ohio.
Detroit: Clyde L. Hause, Chairman; Clyde Mooney, Secretary, Pioneer Engineering & Mfg. Co., Detroit, Michigan.
Elmira: J. R. Blank, Chairman; E. J. Carlton, Secretary, 295 Denison Parkway, Corning, N. Y.
Golden Gate: Carl W. Horack, Chairman; Walter Kassebohn, Secretary, c/o Marchant Calculating Machine Co., Oakland, California.
Greater New York: Thomas P. Orchard, Chairman; Holbrook L. Horton, Secretary, 148 Lafayette Street, New York City.
Hartford: Frederic L. Woodcock, Chairman; Harry J. Hauck, Secretary, 22 North Wellington Street, New Britain, Conn.
Houston: Floyd E. Doty, Jr., Chairman; Louis M. Krausse, Secretary, c/o Krausse Mfg. Tool Co., Houston, Texas.
Indianapolis: H. D. Hiatt, Chairman; R. D. Harris, Secretary, 5044 E. 10th Street, Indianapolis, Indiana.
Milwaukee: Harold L. Heywood, Chairman; Julius A. Riedl, Secretary, c/o Seaman Body Corp., Milwaukee, Wisconsin.
(Moline) Tri-Cities: Joseph B. Morganthall, Chairman; W. E. Fidler, Secretary, c/o Reynolds Engineering Co., Rock Island, Illinois.
New York-New Jersey: W. T. Gray, Chairman; Ben C. Brosheer, Secretary, 330 W. 42nd St., New York City.
Ontario: Arnold Thompson, Chairman; Leonard G. Singer, Secretary, c/o Williams & Wilson, Ltd., Toronto, Ontario, Canada.
Peoria: Joseph L. Berry, Chairman; J. Luther Jones, Secretary, 710 W. Carrington Ave., Peoria, Illinois.
Philadelphia: Paul W. Frankfurter, Sr., Chairman; F. H. Jennings, Secretary, 3452 Ludlow Street, Philadelphia, Pa.
Pittsburgh: W. B. Pierce, Chairman; E. D. Gangwere, Secretary, c/o Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.
Racine: Adolph Zaborowski, Chairman; Norman K. Helding, Secretary, c/o Modine Mfg. Co., Racine, Wisconsin.
Rochester: John C. Dense, Chairman; Milton L. Roessel, Secretary, c/o Eastman Kodak Camera Works, Rochester, New York.
Rockford: Kenneth W. Lund, Chairman; Burdette E. Davis, Secretary, 1603 Myott Avenue, Rockford, Illinois.
Schenectady: F. J. Diehl, Chairman; D. G. Saurenman, Secretary, 6 North Toll St., Scotia, N. Y.
Seattle: W. Carl Fields, Chairman; R. J. McCafferty, Secretary, Route 11, Box 274A, Seattle, Washington.
South Bend: E. B. Barber, Chairman; Hale W. Parrish, Secretary, c/o Parrish Machine Company, South Bend, Ind.
Southern Connecticut: New Haven, Conn. Henry J. Bellemore, Chairman; A. H. Hitchcock, Secretary, c/o High Standard Mfg. Co., New Haven, Ct.
Springfield: Frank W. Curtis, Chairman; K. T. Miller, Secretary, c/o K. Miller Tool & Mfg. Co., Inc., Springfield, Mass.
St. Louis: D. D. Burnside, Chairman; Clarence Miller, Secretary, c/o Measuregraph Co., St. Louis, Mo.
Syracuse: Charles T. Allen, Chairman; Willard E. Parish, Secretary, c/o Crouse Hinds Co., Syracuse, N. Y.
Toledo: Lorence E. Rennell, Chairman; Rolland H. Mogle, Secretary, c/o The Electric Auto-Lite Co., Toledo, O.
Twin Cities: George W. Wise, Chairman; Herman L. Seaberg, Secretary, c/o Farwell, Ozmun, Kirk & Company, St. Paul, Minn.
Twin States: Springfield, Vermont. Wilbur Handy, Chairman; Milan Jennings, Secretary, Box 316, Charlestown, N. H.
Worcester: Raymond A. Cole, Chairman; Charles A. Banks, Secretary, c/o Heald Machine Co., Worcester, Mass.
Western Michigan: Joseph Monahan, Chairman; Elmer J. Roossien, Secretary, c/o Keeler Brass Co., Grand Rapids, Mich.
(York) Central Pennsylvania: Ray Wentzler, Chairman; M. G. Leeson, Secretary, c/o York Ice Machinery Co., York, Pa.

Application blanks and information pertaining to membership in the American Society of Tool Engineers may be had by addressing The Tool Engineer, 2842 W. Grand Blvd., Detroit, Mich., or the Secretary's office, 2567 W. Grand Blvd, Detroit, Mich. Dues are $5 initiation fee, $6 per year for senior grade membership and $3 per year for junior grade membership. Junior membership initiation fee $2.

Sundstrand *Works* For Peace


850 Different Sizes
Turned 40% Faster
And...
Note This, Too
★ Simple hand-adjustment of dogs quickly establishes Automatic Stub Lathe operating cycles . . . No cams to make or change.
★ Operator starts cycle in Rapid Approach "A" which automatically changes to Feed "B"; at the end of which disc "D" reverses and returns in Rapid, through "C" back to starting position.

★ High production and *more* high production is the order today. Many Sundstrand machine tools increase output of munitions for defense to insure peace. Others serve by extending peacetime production in which Sundstrand machine tools excel, such as gear blank turning shown above; and other more complex operations.

★ The Automatic Stub Lathe illustrated turns 850 different gear-blanks in small lots, increases former production about 40%, maintains closer tolerance on size and "run-out" . . . sets even higher records on long-run work.

★ All Sundstrand machine tools sketched at right speed defense production and protect your machine tool investment. They give you simple set-up, many speeds and feeds, easy operation; accuracy, power and stamina to hold close tolerances while working highest-speed cutting tools to capacity; adaptability to a wide variety of work. Investigate. Consult our Engineered Production department for tooling suggestions, estimates and earliest deliveries.

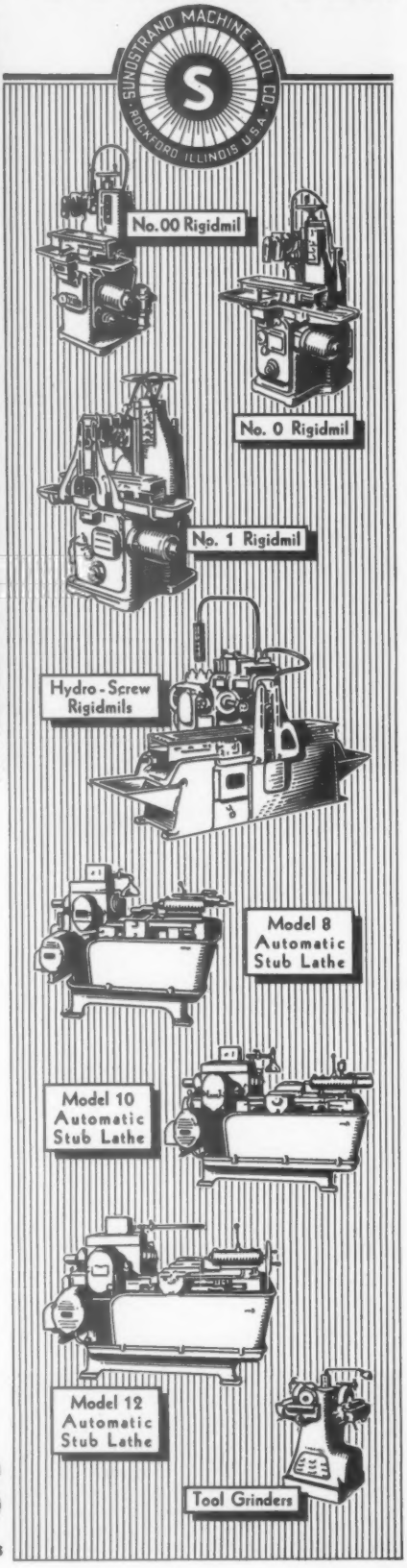
Every member of our organization gladly makes this vow:
"I pledge allegiance to the Flag of the United States of America and to the Republic for which it stands, one Nation indivisible, with liberty and justice for all."

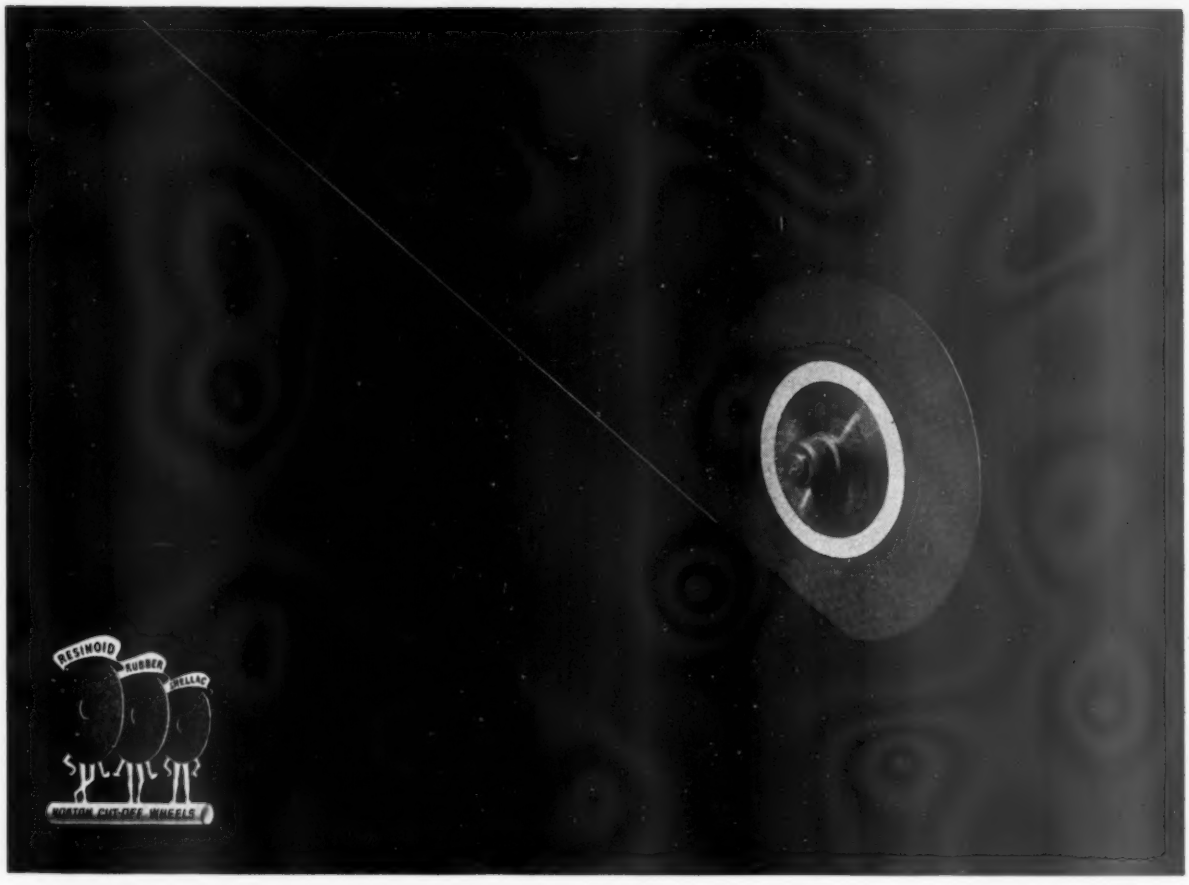
SUNDSTRAND MACHINE TOOL CO.

2532 Eleventh Street, Rockford, Illinois, U. S. A.

RIGIDMILS • STUB LATHES

Hydraulic Operating Equipment — Centering Machines — Tool Grinders





Are You Cutting-Off

Bar Stock? . . . Tubing? . . . Plastics? . . . Broken Tools?

AN instrument manufacturer found a Norton ***Resinoid*** wheel (3724-K8T) faster and more economical than the method previously used. He was cutting molded fibre material.

On high speed steel pipe (cutting wet) a Norton ***Rubber*** wheel (60/1-V8R) reduced wheel cost per square inch of material cut from $0.010 to $0.006 for a builder of folding machines.

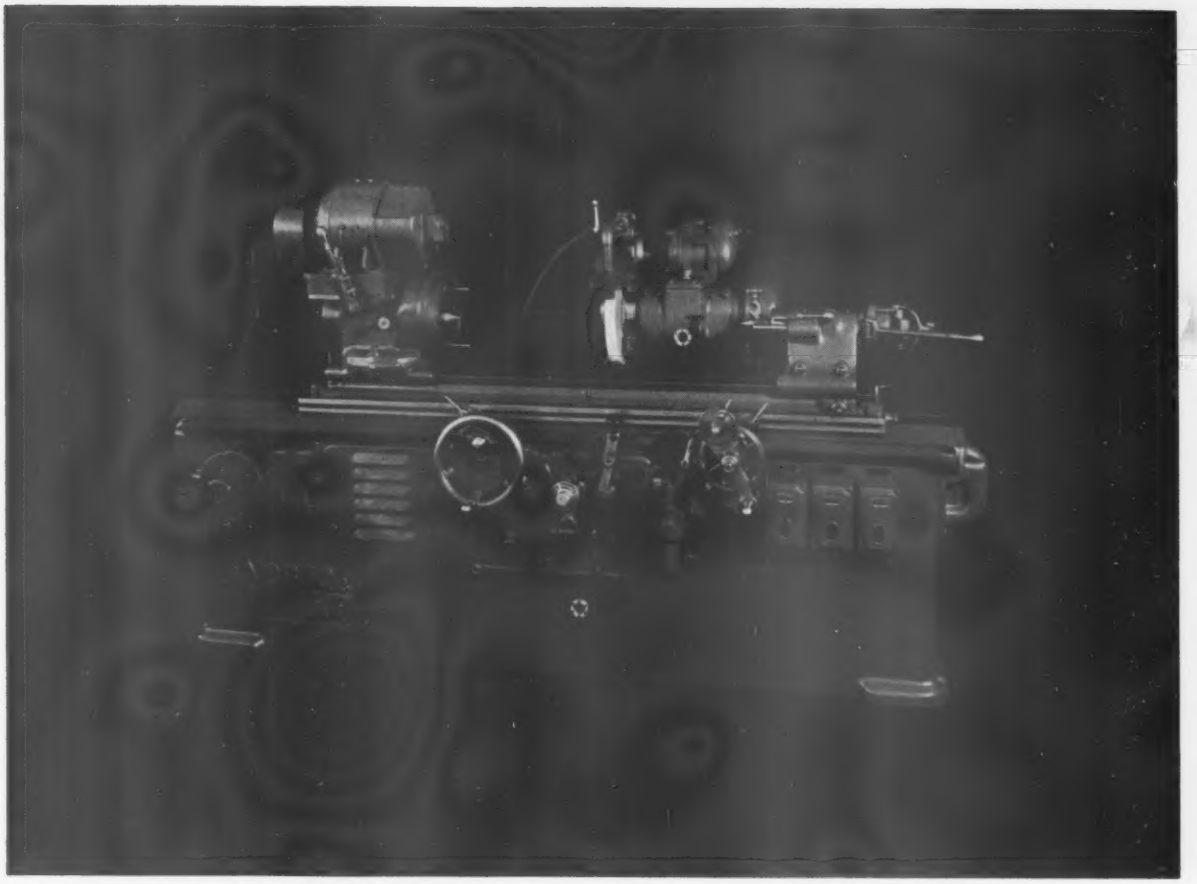
A machine tool builder finds a Norton ***Shellac*** wheel (46-M4L) ideal for salvaging broken taps, drills and tools because of its smooth, cool cutting action on tool steels.

Norton research gave us Resinoid, Rubber and Shellac bonds; Alundum and Crystolon abrasives. And a Norton engineer can tell you which bond and which abrasive to use. No one combination can be satisfactory for all jobs.

The booklet "Norton Cut-off Wheels" contains much helpful information and it will be sent free on request.

W-796A

NORTON ABRASIVES



A Production-Precision Universal Grinder

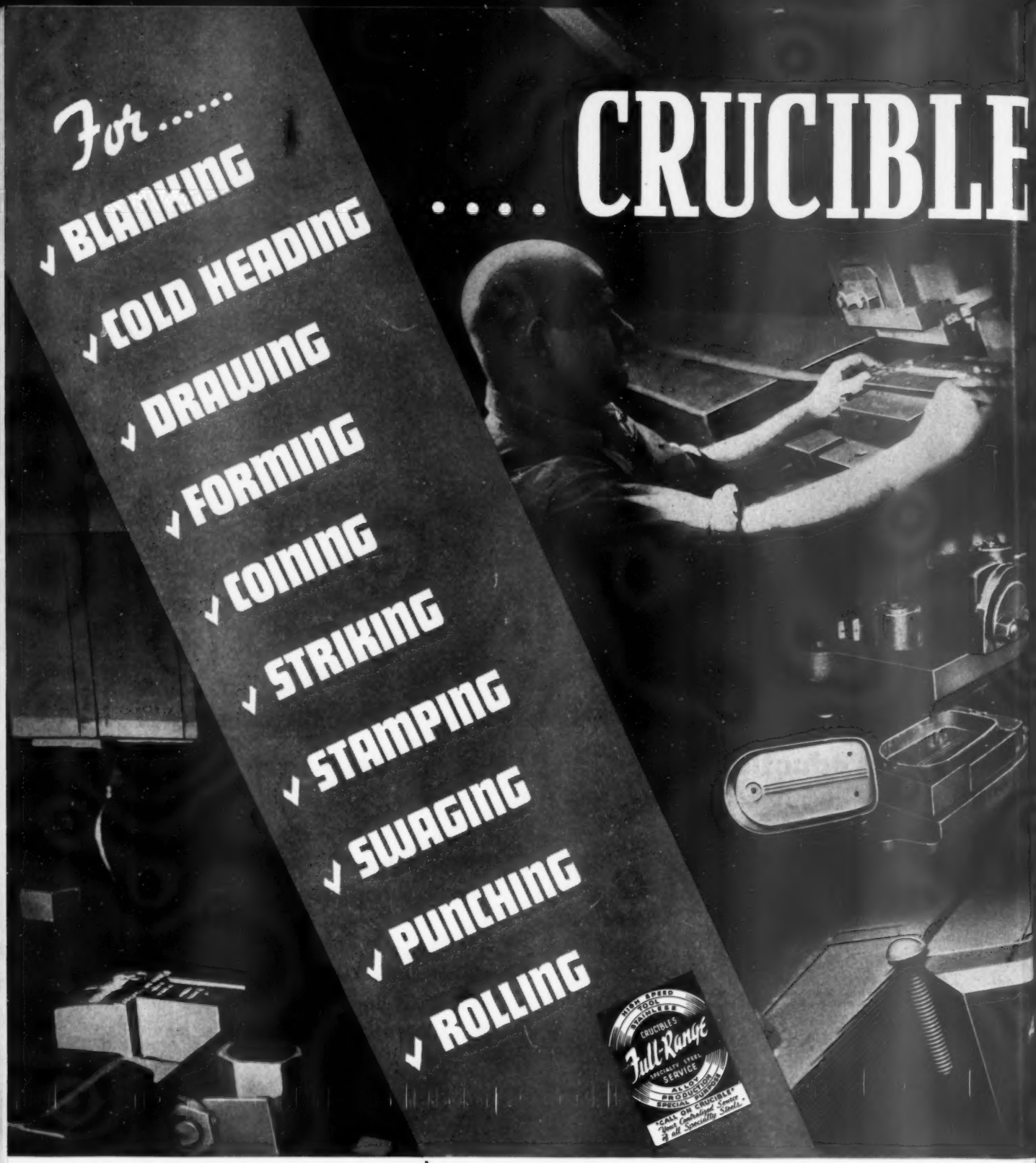
for use in the Tool Room or on the Production Line

IT IS well named a Multipurpose Universal Grinder—for cylindrical, internal, chucking, face and cutter grinding operations can be performed with it. Furnished in three sizes swinging 12", 14" or 16" and each in 36", 48" or 72" lengths between centers, it is an all around, precision grinder that can do a variety of jobs. Rugged enough for roughing operations—accurately built for particular jobs. Send for interesting booklet describing and profusely illustrating the many varied jobs this Norton Grinder can handle. Ask for booklet 1668T.

NORTON COMPANY
Worcester, Mass.
New York—Chicago—Detroit—Pittsburgh—Philadelphia—Hartford

M-435

NORTON GRINDERS



CRUCIBLE STEEL COMPANY of America
CHRYSLER BUILDING, New York, N. Y.

Gentlemen:

☐ Send me copy of reference booklet "Tool Steel for the Non-Metallurgist."

☐ Send me details regarding free copies of this booklet for apprentice training classes. We have.....students.

*Name*_____ *Title*_____

*Firm Name*_____

*Address*_____

*City*_____

AM-M41

Free Booklet!

"TOOL STEEL FOR THE NON-METALLURGIST"

A reference booklet everyone working with TOOL STEEL should have is "TOOL STEEL FOR THE NON-METALLURGIST." Written in a helpful, practical style it is crammed with facts, figures and illustrations of the characteristics, purposes and heat treatment of the leading types of TOOL STEELS. Many organizations are using this booklet as text material in apprentice training classes.

Use handy coupon for your copy and for further information regarding copies for apprentice classes.

offers a "Full-Range" of

for More Profitable Cold

Better Die Steels

Work Production

FASTER production, greater economies, fewer losses and superior workmanship make it profitable for you to standardize on Crucible "Full-Range" Die Steels for cold work. This is the result of using steels especially created for specific purposes . . . so that dubious experiments are unnecessary. Whatever the job, Crucible offers the correct Die Steel with exactly the right characteristics of abrasion resistance, strength, toughness, hardenability and freedom from deformation.

The unfailing uniformity of Crucible Die Steels from piece to piece and lot to lot . . . the result of rigid controls and meticulous inspection tests . . . assures you unvarying performance. Expensive hours of toolmaking and heat treating are profitably invested . . . not wasted.

Avail yourself of Crucible's long and broad experience in improving the profitable applications of Die and other Specialty Steels. Your nearest Crucible Branch-Warehouse will put Crucible Technical Service at your disposal immediately. "Call Crucible."

(All Trade Names in this Advertisement are Registered U. S. Patent Office)

CHOOSE FROM THESE DIE STEELS
TO MEET ALL YOUR COLD WORK REQUIREMENTS

Air Hardening

AIRDI 225
Carbon 2.25, Chromium 12.00, Molybdenum 1.00, Vanadium .25

AIRDI 150
Carbon 1.50, Chromium 12.00, Molybdenum .80, Vanadium .25

AIRKOOL
Carbon .95, Chromium 5.25, Molybdenum 1.15, Vanadium .50

Oil Hardening

KETOS or CHAMPION NON-CHANGEABLE
Carbon .90, Manganese 1.25, Tungsten .50, Chromium .50

PARAGON
Carbon .95, Manganese 1.60, Chromium .60, Vanadium .25

HYCC *(High Carbon, High Chromium Type)*
Carbon 2.25, Chromium 12.00, Vanadium .25

Water Hardening

(Carbon Tool)

- SANDERSON SPECIAL
- CRESCENT SPECIAL
- CRESCENT and SANDERSON EXTRA
- ALVA EXTRA
- LABELLE EXTRA

*Carbon as Desired

Information on other grades for special applications upon request.

SPECIALTY STEELSMITHS to INDUSTRY

CRUCIBLE STEEL COMPANY of America

CHRYSLER BUILDING • 405 LEXINGTON AVENUE • NEW YORK CITY
BRANCHES, WAREHOUSES AND DISTRIBUTORS IN PRINCIPAL CITIES

CONSULT TELEPHONE DIRECTORY OR THOMAS' REGISTER FOR NEAREST OFFICE

BRANCH OFFICES AND WAREHOUSES

ATLANTA, GA.
BALTIMORE, MD.
BOSTON, MASS.
BUFFALO, N. Y.
CHICAGO, ILL.
CINCINNATI, OHIO
CLEVELAND, OHIO
DENVER, COLO.
DETROIT, MICH.
HARRISON, N. J.
INDIANAPOLIS, IND.
LOS ANGELES, CALIF.
MILWAUKEE, WIS.
NEW HAVEN, CONN.
NEW YORK, N. Y.
PHILADELPHIA, PA.
PITTSBURGH, PA.
PROVIDENCE, R. I.
ST. LOUIS, MO.
ST. PAUL, MINN.
SAN FRANCISCO, CALIF.
SEATTLE, WASH.
SPRINGFIELD, MASS.
SYRACUSE, N. Y.
TORONTO, ONT.
WASHINGTON, D. C.

Faster Production CALLS FOR GISHOLT TURRET LATHES

Look ahead . . keep ahead . .
with Gisholt improvements
in metal turning

During the next few years, it will become more and more imperative to obtain faster production and reduce manufacturing costs. This will mean the replacement of obsolescent equipment. Keep a constant check on your machine tools—and especially your turret lathes. Experience proves that they can do more to cut costs than any other single type of machine shop equipment.

New and important improvements have come steadily—and will continue to come. On new Gisholt Turret Lathes, for example, these improvements are making it possible for manufacturers to reduce costs 40% and 50% on many parts. These advancements are of vital importance to you. Don't overlook them.

GISHOLT MACHINE COMPANY
1229 E. Washington Ave., Madison, Wis.

GISHOLT

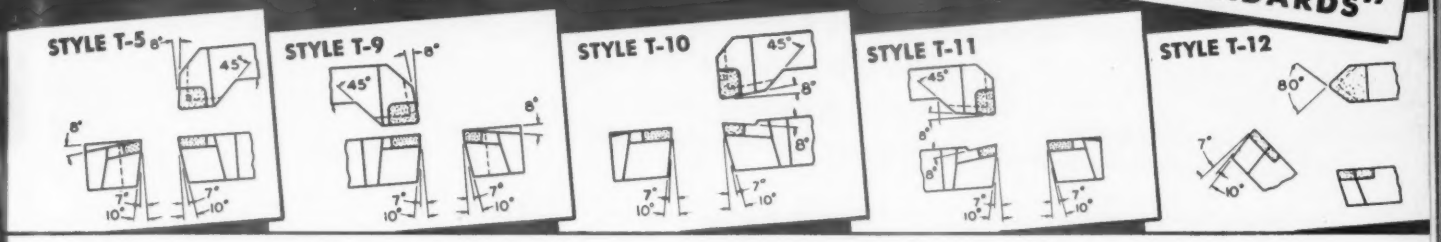
TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

Announcing

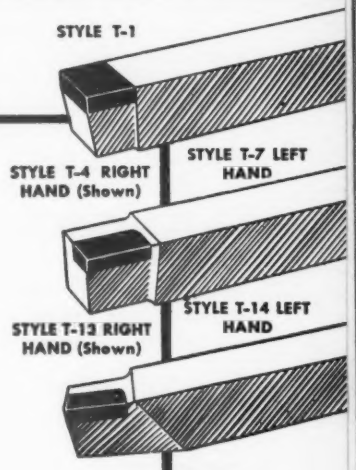
5 NEW STANDARD CARBOLOY TOOLS

NOW BEING ADDED TO STOCK!

Prompt Delivery! ON ALL "STANDARDS"



Plus REDUCED SCALE OF PRICES ON PRESENT STANDARD TOOLS



Six months ago . . . a NEW plan introduced . . . a line of standard, "universal-use" Carboloy tools, produced in large quantities—low priced—and maintained in stock for prompt deliveries.

Today—with a record of thousands of tools shipped from stock weekly for 24 weeks in continuously increasing quantities—that plan has proved itself an outstanding success and the answer to the pyramiding demand for carbide tools.

To further extend the benefits of standardization for the user we are now supplementing the original 5 standard styles with 5 new styles—in 21 sizes. These are also being produced in large quantities to be stocked for prompt delivery. They consist of right- and left-hand offset turning and facing tools, and a "rounded" nose, two-way turning tool.

Coincident with this expansion—prices of the original 5 standard tools have been revised. Reduced prices are in effect for the entire standard tool line with the exception of minimum prices on sizes up to ¾" square. Quantities necessary to obtain minimum prices have been reduced from 50 tools to 10, and, in some cases, 5 tools. Substantial reductions affect price per tool in quantities of 1, 2-4, and 5-9.

With these new, lower prices, and this augmented line of 10 standard styles—NOW—more than ever before, you will find Carboloy Standard Tools your answer to carbide use . . . applicable to at least 80% of all turning, facing, boring jobs on ALL metals and nonmetallics! Write for new catalog GT-129 today.

for STEEL CUTTING

Standard tools styles T-4, T-7, T-5, T-9, T-13 and T-14 tipped with Carboloy Standard Grade 78B for machining steel, are furnished with ground-in chip breaker as shown below.

CARBOLOY COMPANY, INC., 11145 E. 8 MILE STREET, DETROIT, MICH.

Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh • Worcester, Mass.

Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada

"The Mark of CARBOLOY"

CARBOLOY STANDARD TOOLS

CATALOG GT-129

Send for New Catalog GT-129

BARBER-COLMAN STANDARD KEYSEAT CUTTER
Nets Up to 35 Pieces Per Sharpening in Hardened Steel Shafts

. . . . And Motor Builder Gets Additional Savings by Adapting This Standard Cutter to Special Job

This operation is particularly interesting because it shows how two-way savings often can be made in using Barber-Colman Standard Cutters . . . first by peak cutter performance; second by adapting standard cutters to special requirements.

For example, Evinrude Motors grind the side of a standard 5/32" x 7/8" Keyseat Cutter to produce a slot 0.127" — 0.128" wide in the drive shaft illustrated. The shaft is hardened before milling, yet this B-C Cutter nets up to 35 pieces per grind, or 350 pieces in total life.

Perhaps you, too, have milling operations where similar double savings can be made. In any case, you *always* get maximum milling with B-C Standard Cutters. For a convincing tryout, send us your next order for standard cutters which are carried in stock for immediate delivery. Why not order today?

Operation Data

Name of Part — Drive shaft of Evinrude Outboard Motor.

Material — Hy-ten No. 3 B. steel; 38-40 Rockwell C hardness.

Operation — Milling keyway 15/16" long by 0.127"-0.128" wide by 5/16" deep in end of shaft; cut after hardening.

Machine — U.S. Milling Machine.

Cutter — B-C No. 507 Standard Keyseat Cutter. 7/8" diameter, oversize for sharpening. Side is ground to reduce standard 5/32" face to proper width for this operation.

Holding — Special fixture.

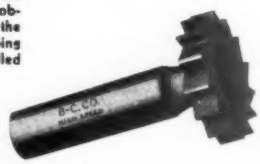
Feed — By hand.

Cutter Speed — 112 r.p.m.

Production Time — 0.79 minutes, floor-to-floor.

Cutter Life — 35 pieces per grind; up to 350 per cutter. New cutter has approximately 0.890" diameter; which is used down to 0.790", removing 0.010" to 0.015" per sharpening.

Comments — Besides the above milling job, the operator also runs a Barber-Colman No. 3 Hobbing Machine which hobs a square on the opposite end of each shaft. While hobbing progresses on one shaft, keyseats are milled on others.



● This is the standard B-C Keyseat Cutter that is adapted to the above milling job. You'll find it listed in 27 standard sizes on pages 92 and 93 in your Catalog K.

Evinrude Motors, Milwaukee, Wisconsin, celebrate their 32nd anniversary this year with 9 basic models ranging from the ½ h.p. *Mate* to the 33.4 h.p. *Speedifour*. Evinrudes incorporate the latest advances in outboard motor building. The tiny *Mate*, proudly exhibited by the young lady above, packs a lively half-horse in only ten pounds and runs ten hours on a gallon of fuel.

BARBER B-C COLMAN PRODUCTS

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

Barber-Colman Company

General Offices and Plant 213 Loomis St., Rockford, Illinois, U. S. A.

Ours Produce More

VASCOLOY-RAMET Tools are making substantial savings and are increasing production in hundreds of important plants.

Not the cheapest tool you can buy, not the highest priced tool, but the tool that cuts the most metal per grind, per tool, per man-hour, per dollar —that is the tool which should be used today.

Every true American is willing and eager to do his part in producing the materials essential in national defense. In machining metal parts, it is more important than ever to use good tools, and to use the right tool for each operation.

Call in a Vascoloy-Ramet factory representative or authorized agent.

Write for the
VASCOLOY-RAMET Tool Catalog

Vascoloy
RAMET
T. M. REG. U. S. PAT. OFF.

VASCOLOY-RAMET CORPORATION

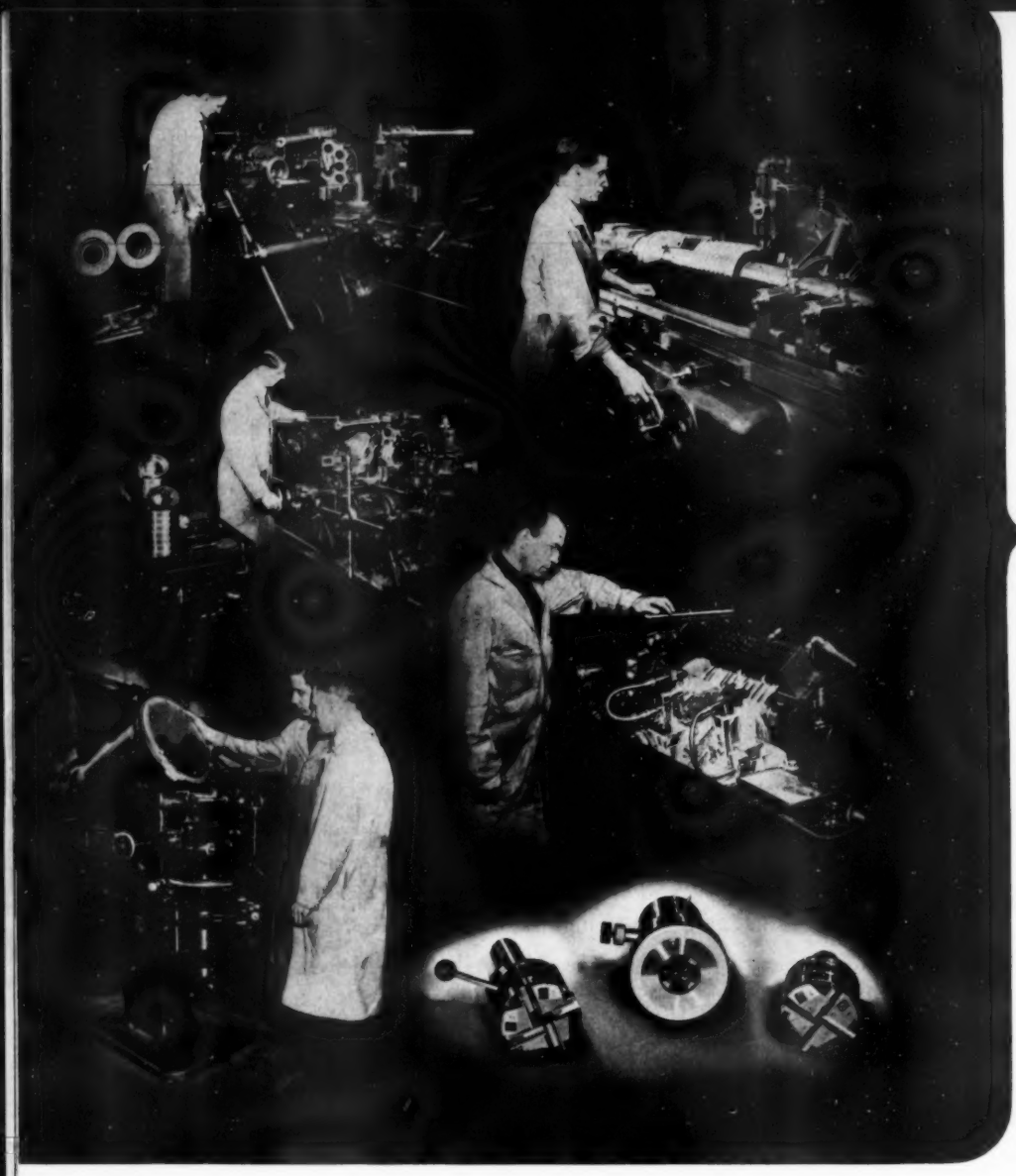
NORTH CHICAGO, ILLINOIS
an affiliate of
FANSTEEL METALLURGICAL CORPORATION
and
VANADIUM-ALLOYS STEEL COMPANY

Tantalum-Tungsten Carbide TOOLS

Factory-Owned Branches: Jersey City . . . Detroit. . . Cleveland . . . Milwaukee . . . Syracuse . . . Pittsburgh . . . Cincinnati . . . Hartford . . . Providence . . . Philadelphia

AUTHORIZED AGENTS IN PRINCIPAL CITIES

In Canada: Carbide Tool & Die Company, Ltd., Hamilton, Ont.



PLAN *for* FUTURE PROFITS *with* JONES & LAMSON EQUIPMENT

THE present emergency offers a double opportunity to alert manufacturers. First and foremost, of course, is the chance to rearm America and safeguard our peace. Second, by choosing it wisely, the same equipment that works for defense today can earn greater profits for you in commerce tomorrow. Before committing yourself to building special machines for defense work, consider the versatility of Jones & Lamson Universal Turret Lathes, Comparators, Die Heads, Automatic Thread Grinders and Fay Automatic Lathes. Not only will they increase your future earning power, but they will handle a big share of your present work to best advantage. That's why it pays to put your production problems up to Jones & Lamson engineers.

JONES & LAMSON MACHINE CO.

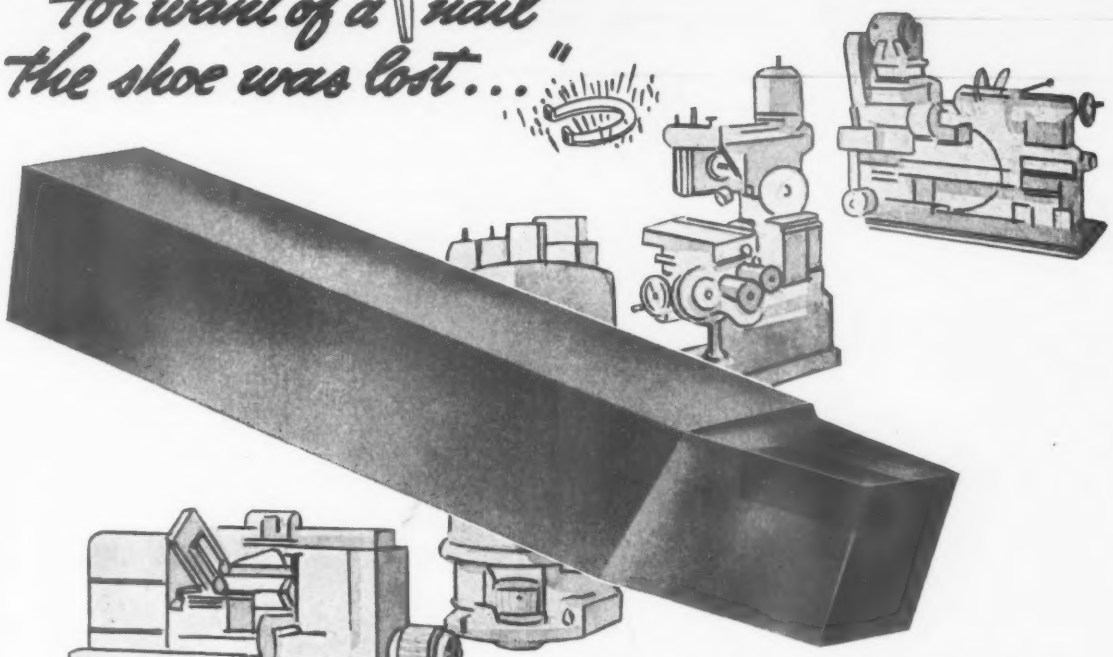
SPRINGFIELD, VERMONT, U. S. A.

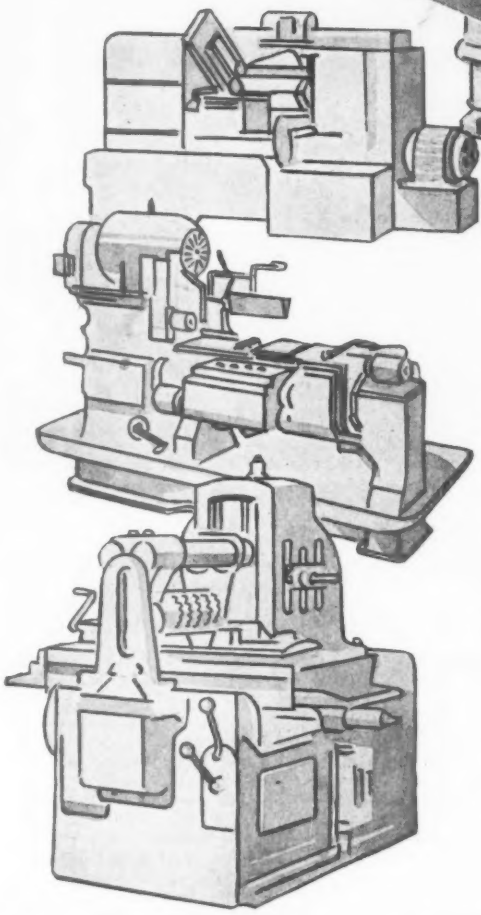
MANUFACTURERS OF: SADDLE & RAM TYPE UNIVERSAL TURRET LATHES . . . FAY AUTOMATIC LATHES . . . AUTOMATIC DOUBLE-END MILLING & CENTERING MACHINES . . . AUTOMATIC THREAD GRINDING MACHINES . . . COMPARATORS . . . TANGENT AND RADIAL, STATIONARY AND REVOLVING DIES AND CHASERS

J&L

PROFIT PRODUCING MACHINE TOOLS

"For want of a nail the shoe was lost..."





Are they TOOLED with FIRTHITE ?

Machine Tools are *only as productive* as the *cutting* tools and bits with which they are equipped. For want of proper Sintered Carbide tools many costly machines may be rendered ineffectual.

FIRTHITE Cutting Tools help to develop the *full-rated performance capacity* of modern machines. Hence machine tool builders will cooperate when you specify "delivery with FIRTHITE Tooling."

Thus, machine tool builders are another source of supply for FIRTHITE Sintered Carbide Tools specially adapted to their equipment. In addition FIRTHITE Tools are sold by Firth-Sterling plants, offices, and warehouses in 9 cities and through local authorized Tool Makers. Or, if you prefer, FIRTHITE Tools can be made in your own shop in four basic operations, with ordinary tool room equipment. Information about any of these optional sources, which assure you of the advantages of genuine FIRTHITE Tooling, will be furnished upon request.

FIRTH-STERLING STEEL COMPANY

OFFICE AND WORKS:
McKEESPORT, PA.
BRANCH WAREHOUSES:
NEW YORK CHICAGO
HARTFORD PHILADELPHIA
LOS ANGELES DAYTON
CLEVELAND DETROIT

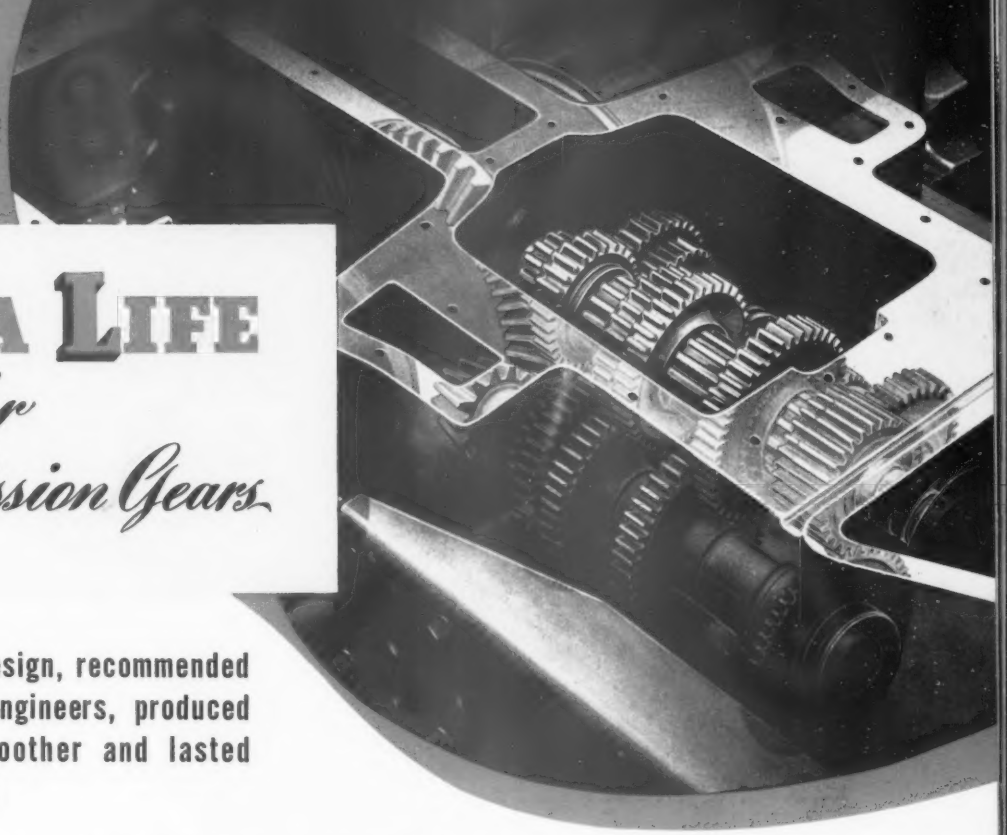
A nearby "Logan" Representative will be glad to make recommendations on your own requirements.

"LOGAN" MANUFACTURES A COMPLETE LINE OF AIR OR HYDRAULIC EQUIPMENT AND CONTROLS...

The "LOGAN LINE" of Air or Hydraulic equipment and Controls is designed to save time, effort and motion. Easily adaptable to all types of production machines, thousands of uses have been found for this equipment in the leading industrial plants of the world. The line is complete and includes Air and Hydraulic Control Valves, Rotating and Non-Rotating types of Air and Hydraulic Cylinders, Air and Hydraulically Operated Chucks, Hydraulic Power Units, Relief and Reducing Valves, Presses, Vises, "Sure Flow" Coolant Pumps and other allied devices. "LOGAN" Engineers will be glad to make recommendations on your requirements.

Logansport Machine, Incorporated
902 Payson Road Logansport, Indiana

HELPING SOLVE INDUSTRY'S PRODUCTION PROBLEMS



EXTRA LIFE *for* *Transmission Gears*

A change in tooth design, recommended by "Illinois Tool" engineers, produced gears that ran smoother and lasted many times longer!

The arbitrary selection of so-called "standard" gear tooth dimensions by rule-of-thumb methods does not always result in a choice of gears best suited for the particular class of work involved. Among the problems that must be thoroughly understood to secure the fullest efficiency from gear drives are:

(1) WHEN and WHY to use 14½° pressure angle

(2) WHEN and WHY to use 20° or any other pressure angle

(3) WHEN and WHY to use spur and helical gears

(4) WHEN and WHY to use "long and short" addenda designs

(5) WHEN and WHY to use "full depth" standard gear teeth and "stub tooth" gear designs

Many manufacturers have learned to rely on "Illinois Tool" engineers for competent advice on such gear design problems. If your gearing problem is of a special nature, you may be able to profit similarly by submitting it to the Illinois Tool Works for analysis and suggestions.

ILLINITE

HIGH SPEED
PRODUCTION TOOLS

Milling Cutters
Ground Hobs
Broaches
Shaper Cutters
Ground Form Tools
Special Tools
Die Filing Machines
Gear Measuring Machines

ILLINOIS TOOL WORKS

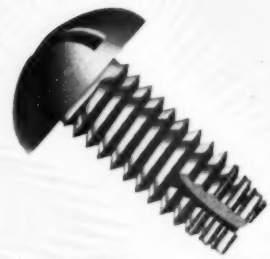
MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

2501 N. KEELER AVENUE, CHICAGO, ILLINOIS · IN CANADA: CANADA ILLINOIS TOOLS, LTD., TORONTO, ONTARIO

Copyright 1941, Illinois Tool Works

"Built-in" Tap assures better fastenings!

THREE THREAD-CUTTING SCREWS AND A THREAD-FORMING SCREW



TYPE 1 Thread-Cutting Screw

TYPE 2 Thread-Cutting Screw

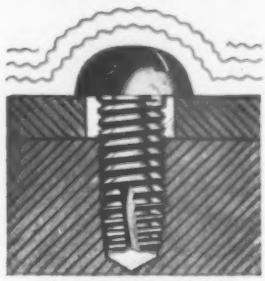
TYPE 9 Thread-Cutting Screw

TYPE 21 Thread-Forming Screw

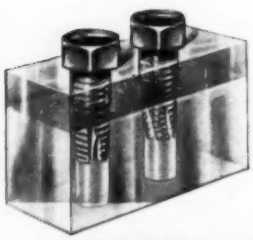
SHAKEPROOF

Thread-Cutting Screws **Actually cut their own standard machine screw threads in metals and plastics!**

The exclusive spring-action slot illustrated above is truly a "built-in" tap. When the screw is driven into a drilled or punched hole, the serrated cutting edge bites into the work and cleanly cuts away the material to make a standard machine screw thread. Because each screw stays in the thread it has cut for itself, a snug, tight fastening is secured. The fit is so perfect that no "play" exists and consequently vibration cannot start any loosening movement. Be sure the screws you use have a "built-in" tap and you'll be certain of stronger and tighter fastenings!



SNUG FIT PROTECTS AGAINST VIBRATION



TWO SPECIAL TYPES FOR PLASTICS!

Now you can fasten plastic parts without bothering with threaded inserts or pre-tapping operations. Types 2 and 9 illustrated at the left will cut their own threads in any kind of plastic —either molded or laminated—without danger of fracturing the material.

WRITE FOR FREE SAMPLE KIT!

SHAKEPROOF LOCK WASHER CO.
Distributor of Shakeproof Products
Manufactured by ILLINOIS TOOL WORKS
2501 North Keeler Avenue, Chicago, Illinois
Plants at Chicago and Elgin, Illinois
Canadian Plant: Canada Illinois Tools, Ltd., Toronto, Ontario
Foreign Licensees: Barber and Colman, Ltd., Brooklands, Manchester, England; Carr Fastener Co. of Australia, Ltd., Royal Park, South Australia
Copyright 1941 Illinois Tool Works

ALL SHAKEPROOF SCREW PRODUCTS AVAILABLE WITH PHILLIPS RECESSED HEADS!

SHAKEPROOF

"Fastening Headquarters"

SEMS Fastener Units . . . Lock Washers . . . Locking and Plain Terminals

Thread-Cutting Screws . . . Locking Screws . . . Spring Washers . . . Special Stampings

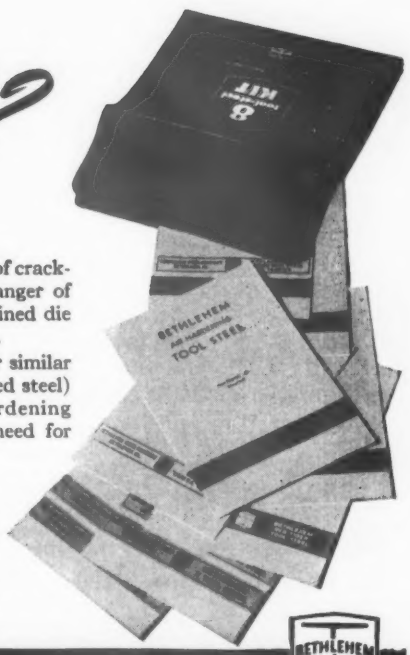
Ever consider hardening dies in AIR?

From 1550 to 1625° F.

Bethlehem Air-Hardening Die Steel, when air-cooled from a *low temperature (1550 to 1625 deg. F.)* develops a strength and hardness comparable to that of many liquid-quenched steels.

As a result, Bethlehem A-H can be used for dies which formerly required oil-hardening or water-hardening steel. When A-H is used, heat-treatment is simplified. The die distorts less in cooling. The hazard of cracking is minimized. There is less danger of overheating the corners of a machined die when using the lower temperatures.

If you produce dies, punches, or similar tools (and are using liquid-quenched steel) investigate Bethlehem Air-Hardening steel. It may be just what you need for the job.



Bethlehem's compact 8 tool-steel kit offers a set of time- and shop-tested steels that will handle 90 per cent of the jobs in any shop. Its use cuts inventories, simplifies heat-treatment, develops standard practices which save time and produce better finished parts. Each steel in the set is an outstanding performer. Write to Bethlehem Steel Company, Bethlehem, Pa., for the descriptive kit shown here. It's free.

BETHLEHEM STEEL COMPANY

BETHLEHEM STEEL

IN 1797
The Maudslay Lathe — designed and built in England by Henry Maudslay in 1797. Considered the first practical screw cutting lathe—the basic idea from which all modern machine tools have been developed.
SOUTH BEND
IN 1941
The South Bend Lathe—a masterpiece of the machine tool builder's art. A modern back-geared screw cutting precision lathe—designed and built to meet present day shop requirements for power, speed and accuracy.

IT IS an international tradition that the United States leads the world in the production of fine machinery. This enviable American accomplishment may be attributed to efficient management, capable engineering and *modern machine tools.* We take pride in presenting the new Series "S" South Bend Lathe for 1941—our contribution to American Industry—a *modern machine tool.*

WE FAVOR ADEQUATE PREPAREDNESS FOR NATIONAL DEFENSE

TRADE MARK SOUTH BEND LATHES

SOUTH BEND LATHE WORKS

477 EAST MADISON STREET, SOUTH BEND, INDIANA, U. S. A.

A moderate-size machine shop, booked to capacity with orders for shells, found finishing operations slowing production. Installation of Thor High-Frequency Grinders stepped it up 37%; soon put the work "on schedule"—without the use of more tools than previously assigned to the job. In addition, substantially lower costs are already resulting.

More Power . . . Lighter Weight . . . Constant Speed

High Frequency Electric Tools

Plants with ten or more universal electric tools can increase production 30%—and reduce costs too!

● THE TOOLS which have always ranked highest for performance efficiency now take on new importance with today's necessity for greater production.

Recent improvements in design, combined with the basic advantages characteristic of High Frequency Electric Tools, make them more than ever worth serious consideration by men responsible for getting results.

Extensive research has demonstrated that High Frequency Tools (operating on 180 cycle, 3-phase, 220 Volt current) can increase the production of shops now operating ten or more universal electric tools by at least 30%.

This increase is obtained with *no increase* in cost because of more efficient operation due to *constant speed under load and greater power per pound of weight.*

At the same time, maintenance costs are reduced because the simplified construction of High Frequency tools eliminates commutator, brushes and other parts that cause repair expense in universal tools.

If today's production requirements demand that your plant do more work . . . *faster*, then find out now what Thor High Frequency Tools can do for you. Send for the booklet offered below.

●

INDEPENDENT PNEUMATIC TOOL CO.

200 S. Jefferson St. Chicago, Illinois

SEND COUPON FOR *Free* BOOKLET

Independent Pneumatic Tool Co.
200 S. Jefferson St., Chicago, Illinois
Send booklet "Saving Time with Thor High Frequency Electric Tools".

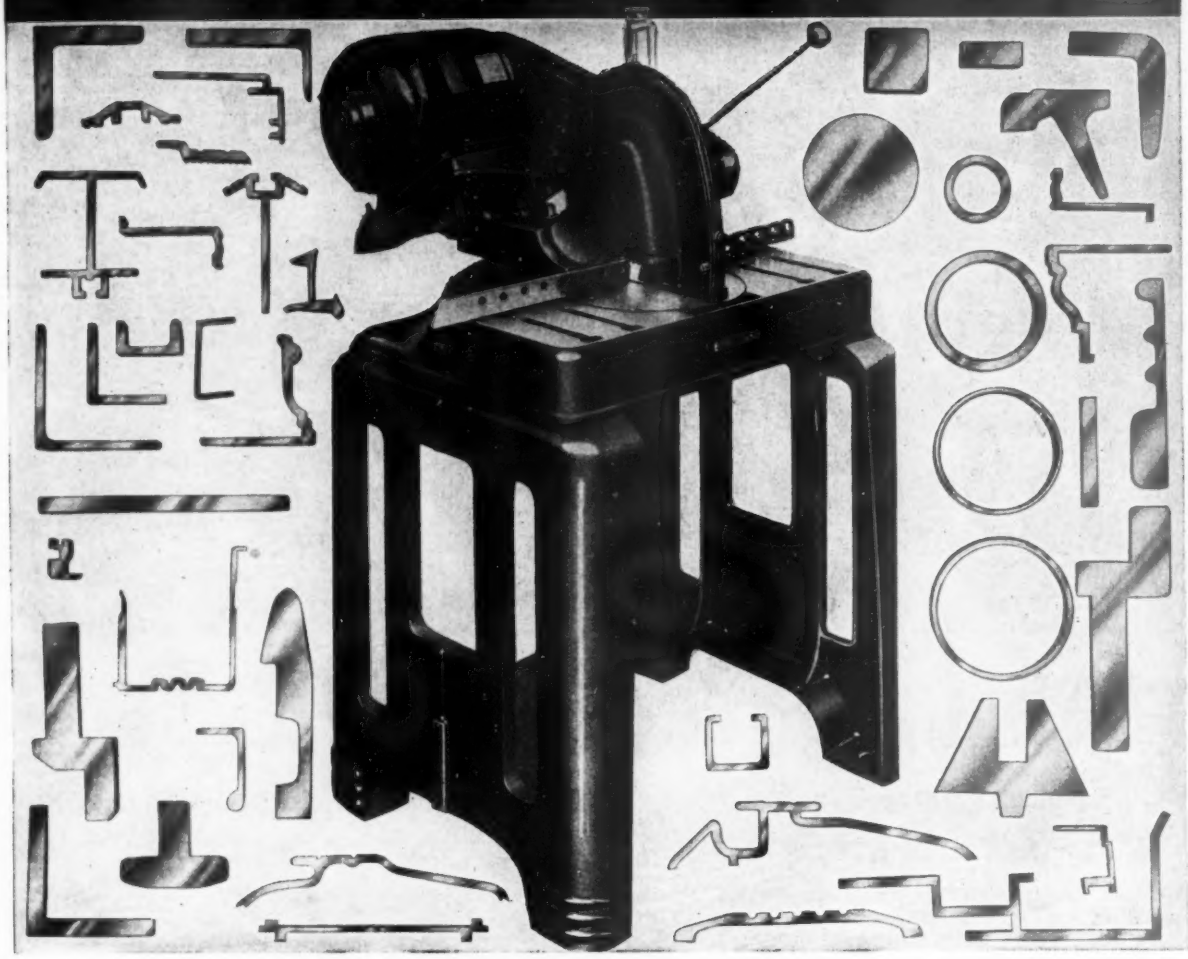
NAME.....

COMPANY.....

ADDRESS.....

CITY.....STATE.....

Here's the Cut-Off Machine that can do these Jobs



New DELTA Machine Cuts Non-Ferrous Metals with POLISHED SMOOTHNESS

The photograph above shows some of the actual shapes and sizes handled by the new Delta Cut-Off Machine. This remarkable unit is designed especially for cutting copper, brass, aluminum and other non-ferrous metals. It is equipped with a special high-speed steel blade and oiling device which feeds cutting oil to the blade. It leaves the cut perfectly smooth, thus eliminating additional finishing and polishing operations. Here is a powerful, accurate machine made available at a fraction of the prices customarily charged for machines of this type.

CUTS THESE MATERIALS— SOLID SECTIONS: Soft Brass up to 1⅛" diameter; Half-Hard Brass, up to 1¼" diameter; Aluminum, up to 1⅛" diameter; Aluminum Extruded Sections, up to equivalent of 2 sq. in.; Copper, up to 1⅛" diameter, or equivalent of 2 sq. in.; Magnesium (Dow Metal), up to 1¼" diameter; Micarta and Similar Rods, up to 1⅛" diameter. TUBULAR SECTIONS: Soft Brass, Hard Brass, Aluminum, Copper, Dow Metal, Micarta and Similar Tubing, All up to 2" diameter.

The Delta Mfg. Co. also makes the complete line of Delta 14" and 17" single and multi-spindle drill presses—in use in many thousands of plants, large and small, all over the world.

Send for Special Cut-Off Machine Bulletin

giving full details and prices on this Delta Cut-Off Machine and accessories.

The DELTA MFG. CO.

(Industrial Division)

661 E. Vienna Ave., Milwaukee, Wisconsin

DELTA MFG. CO. (Industrial Division)
661 E. Vienna Ave., Milwaukee, Wis.

Please send me special bulletin on the new Delta Cut-Off Machine for non-ferrous metals. Also send latest Delta Catalog of Industrial Power Tools.

Name .....

Address .....

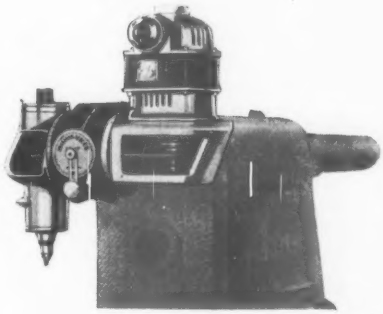
City ..... State .....

THE HIGH SPEED MILWAUKEE MIDGETMILL GETS THE MOST FROM END MILLS AND MILLING MACHINES

Get the most from end mills and milling machines — get the correct high speeds that mean smooth, clean, accurate work and long tool life. Adaptable to any milling machine — completely universal — mills, drills and bores — fast, safe and easy to set up — a necessity for the proper use of end mills — innumerable applications to work on dies, fixtures, templates, etc.

KEARNEY & TRECKER CORP., *Milwaukee, Wis., U.S.A.*

The "THOU-METER" — exclusive with the Milwaukee Midgetmill. Set cutting tools by direct reading—merely touch tool to work, set dial at zero, and mill, drill and bore until dial shows correct reading—in thousandths. No graduations—dials—stops—binding screws.



The MILWAUKEE SPEEDMILL — for accurate end mill speeds up to 5300 rpm. Easy to operate, furnishes closer sizes and improved finishes —adaptable to all types of milling machines.

Write now for complete information on the MILWAUKEE MIDGETMILL and SPEEDMILL — built to the same quality standards as Milwaukee Milling Machines.

Products of

KEARNEY & TRECKER CORPORATION
MILWAUKEE MILLING MACHINES

MONEY-SAVING IDEAS

for EQUIPMENT BUILDERS

Nickel Cast Iron News
Published in the Interest of Producers and Users of Cast Iron
Orientals Make Good Use of Alloy Iron Castings
New Abrasion Service Records Made Available
Nickel Steel Topics
Published in the Interest of Producers and Users of Nickel Alloy Steels
Screwdrivers Made to Withstand Rough Treatment
Nickel Steels Play Important Role in Machine Tools
"Bicycle Built for Two" (Speeds)

Two periodicals mailed FREE on request, cite actual cases

NICKEL STEEL TOPICS—This twelve page illustrated, miniature newspaper is published every second month and is devoted exclusively to Nickel alloy steels. Each issue is packed with illustrated technical and news articles dealing with the production, treatment and uses of these steels in rolled, forged and cast forms. Special features such as a question and answer page and pertinent editorials on technical subjects involving the uses of Nickel alloy steels are included in every issue.

NICKEL CAST IRON NEWS—This publication is a 12 page, illustrated newspaper-type periodical devoted to technical and news articles featuring the production of Nickel cast irons. Editorials and a question and answer section on these materials are special features in each issue. "Nickel Cast Iron News" alternates on a monthly basis with "Nickel Steel Topics".

NICKEL STEELS • CAST IRONS

AVAILABLE ON REQUEST—More Than 75 Publications Covering Various Industrial Fields, Applications and Production Procedures.

Permanently valuable for reference purposes are a large group of publications applying to various industrial applications and production procedures involving the uses of Nickel alloy steels, Nickel cast irons or Nickel containing non-ferrous materials. The titles of these publications with a brief description of their respective contents are set forth in a special catalogue, available on request. For your copy, simply return the coupon below.

The factual, informative material appearing in "Nickel Steel Topics" and "Nickel Cast Iron News" is of considerable practical value as evidenced by the fact that over 100,000 engineers, metallurgists and production men are now regularly reading these publications. You may read them too, at no cost or obligation. Simply mail the coupon at right.

I'D LIKE TO KEEP UP WITH THE NEWS

The International Nickel Company, Inc., 67 Wall St., New York, N. Y.

Gentlemen: Without cost or obligation, please send me the publications checked:

Nickel Steel Topics ☐ Nickel Cast Iron News ☐ List of Current Publications ☐

Name _____

TE 4-41

Address _____

City _____ *State* _____

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

The "Inside Story" of OILGEAR *fluid power*

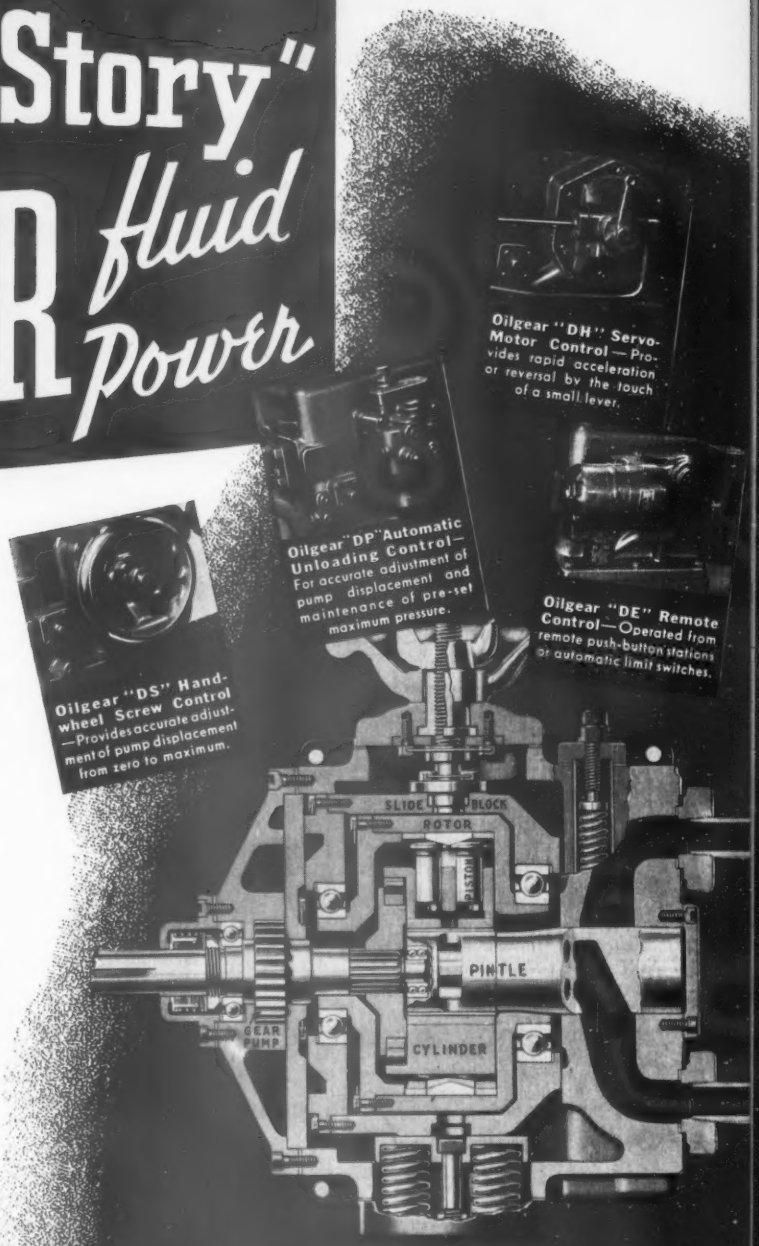
More and more leading machine builders are examining their designs closely with an eye to adopting Oilgear Fluid Power. For they recognize in Oilgear's simple, compact, efficient design, the years of research, the unique developments, the precision construction, and the thoroughly sound engineering that have made Oilgear the leader in the hydraulic field.

The new simplified construction of Oilgear Pumps and Motors brings about an important reduction in size . . . gives you more power in less space. It has been carried "all the way through" and results in fewer moving parts, less maintenance, exceptional speed control, and trouble-free operation. High efficiencies are gained by automatic pressure lubrication, large built-in unobstructed oil passages, anti-friction bearing mountings for moving parts, and smaller and lighter pistons. Oilgear Pumps and Motors may be used with any kind of drive—coupling, belts, chain, or gear—and integrally mounted. Output may be smoothly, steplessly varied from zero to maximum to fit exacting variable speed installations.

There's the "inside story" of Oilgear Pumps and Motors . . . *facts* . . . which add up to *efficiency, durability, ease of control,* and *flexibility* . . . the kind of performance you need for today's machines. But get the *complete* "inside story" of what Oilgear Fluid Power Equipment means to the performance of your machines. Use the coupon below immediately. THE OILGEAR COMPANY, 1312 W. Bruce Street, Milwaukee, Wis.

Trademark Reg. OILGEAR U. S. Pat. Off.

Feeds • Pumps • Cylinders • Valves • Motors • Transmissions Horizontal and Vertical Broaching Machines • Horizontal and Vertical Presses • Custom Built Machines


Oilgear "DH" Servo-Motor Control—Provides rapid acceleration or reversal by the touch of a small lever.
Oilgear "DP" Automatic Unloading Control—For accurate adjustment of pump displacement and maintenance of pre-set maximum pressure.
Oilgear "DE" Remote Control—Operated from remote push-button stations or automatic limit switches.
Oilgear "DS" Hand-wheel Screw Control—Provides accurate adjustment of pump displacement from zero to maximum.
SLIDE BLOCK
ROTOR
PISTON
PINTLE
GEAR PUMP
CYLINDER

Oilgear Variable Displacement Unit

Rotor and cylinder rotate with shaft. Displacement varied by changing position of slide block. Permits oil delivery to be varied smoothly over a stepless range in either direction from zero to maximum.

• • •

There's a wide selection of accurate direct and remote controls available for each size of unit to meet the requirements of your specific applications.

OILGEAR

THE MOST EFFECTIVE APPLICATION OF fluid power

THE OILGEAR COMPANY, 1312 W. Bruce Street, Milwaukee, Wisconsin

Please send me a copy of Bulletin 47000 without obligation.

*Name*_____

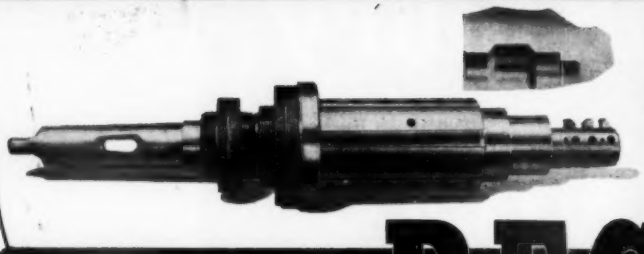
*Company*_____

*Address*_____

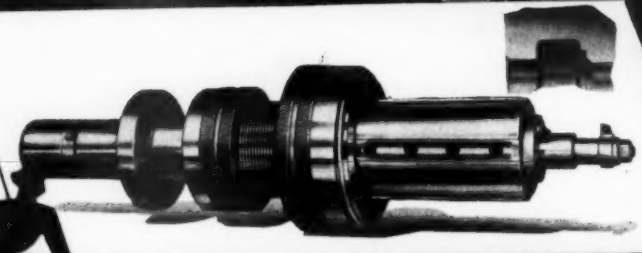
*City*_____ *State*_____

. . . Step-up Production

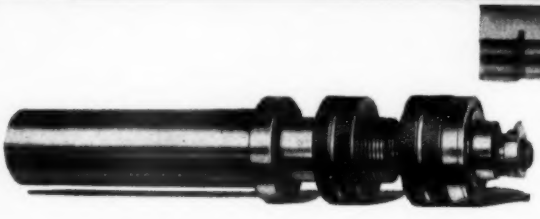
with AUTOMATIC RECESSING TOOLS



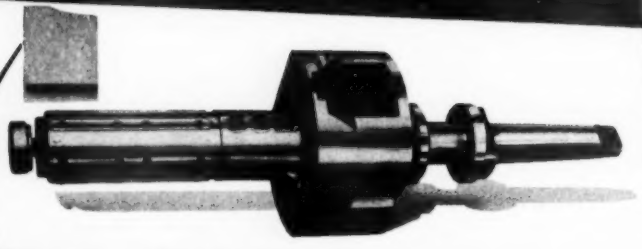
Three chamfering cuts made at same time on airplane motor casting by this automatic tool.



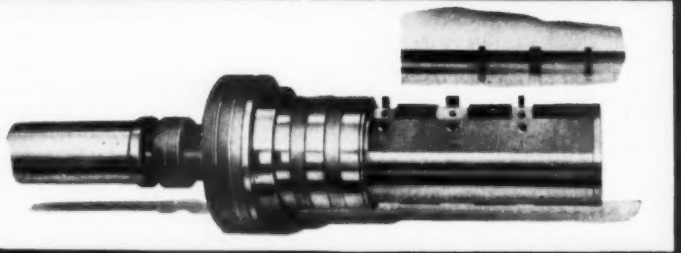
Automatic tool for cutting recess and two chamfers in supercharger part.



For automatic screw machine to obtain finished chamfer or radius where usual burr is left by cut-off tool.



Slide action tool to chamfer, rough and finish bore 3 5/16" hole, while finish facing 6 5/8" pad on reduction gear housing of airplane motor.



Tool for recessing three 5" diameter grooves in finished pump body.

You can groove faster, more accurately and economically with a Scully-Jones recessing tool. . . . These automatic tools are suitable for production work on Turret Lathes, Automatic Screw Machines, Drill Presses or Horizontal Boring Mills for grooving, undercutting, recessing, necking and facing.

Adjustment is provided for the tool bit after grinding as well as location of groove and correct depth setting to control the diameter of recess.

Send us blueprint or sketch of your recessing problem or ask for Folder No. 110.

SCULLY-JONES AND COMPANY

1901 So. Rockwell Street
CHICAGO, ILLINOIS

Fast Production Needs Correctly Ground Tools!

GRIND THEM ON A SELLERS TOOL GRINDER!

More vital than ever before is the need for correctly ground tools and tool bits—for it is only when tools are properly shaped and have the right clearances and angles of inclination that they can take heavier cuts at higher speeds for fast production work.

Sellers Tool Grinders provide a simple and efficient means of accurately producing correct tool shapes and of ***duplicating these shapes on any number of tools.***

To keep in step with today's production demands, you need a Sellers Tool Grinder in your plant.

Write for the Sellers 4-T Tool Grinder Bulletin.

WILLIAM SELLERS & CO., Incorporated

1626 Hamilton Street **Philadelphia, Pa.**

Sellers

HAYNES STELLITE ALLOY prolongs the life of hot-work dies . . .

and in addition saves refitting time

Haynes Stellite hard-facing alloy increases the life of hot-work dies because it resists abrasive wear at high temperatures. In addition, maintenance costs are greatly reduced—not only because dies have to be changed less frequently, but also because you can refit a hard-faced die in much less time than is required for refitting a plain steel die.

Shown at the right are 8 dies—used in the plant of a large motor manufacturer—which were hard-faced with Haynes Stellite No. 6 alloy. These hard-faced dies have outlasted steel dies from 3 to 6 times, and they are refitted in approximately half the time required for the ordinary dies.

Our Representatives Can Help You Use Hard-Facing Profitably

Haynes Stellite alloy is being used *profitably* on wearing parts in practically every industry. Haynes Stellite sales engineers and Linde service operators will be glad to give you practical assistance and to show you how hard-facing makes possible higher production . . . with lower costs and fewer shutdowns. Write or phone the district office nearest you.

Headquarters for Hard-Facing Materials

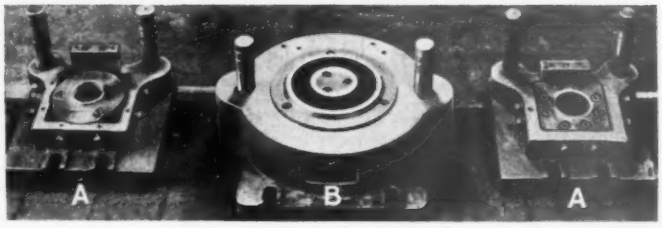
HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

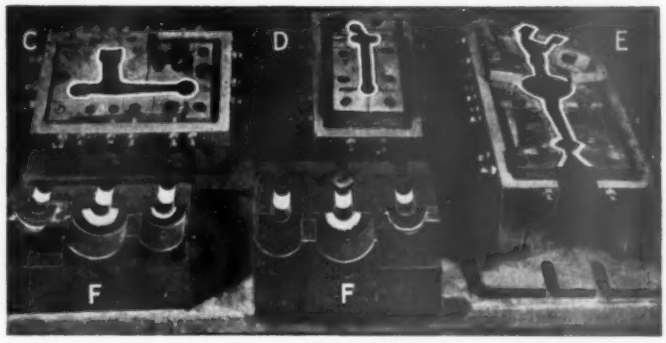
New York, N. Y. UCC **Kokomo, Indiana**

Chicago — Cleveland — Detroit — Houston
Los Angeles — San Francisco — Tulsa

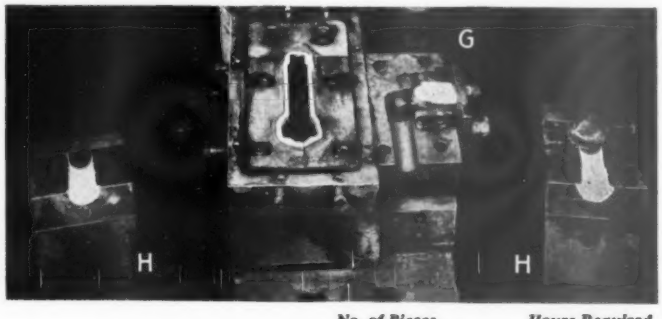
HAYNES STELLITE TRADE MARK



	No. of Pieces Between Refittings	*Hours Required to Refit Die*
A—Hot-Trimming Die for Rear Axle Differential Gear	Steel—4,000 Hard-Faced—20,000	Steel—16 Hard-Faced—6
B—Hot-Trimming and Piercing Die for Ring Gear	Steel—2,500 Hard-Faced—15,000	Steel—20 Hard-Faced—12



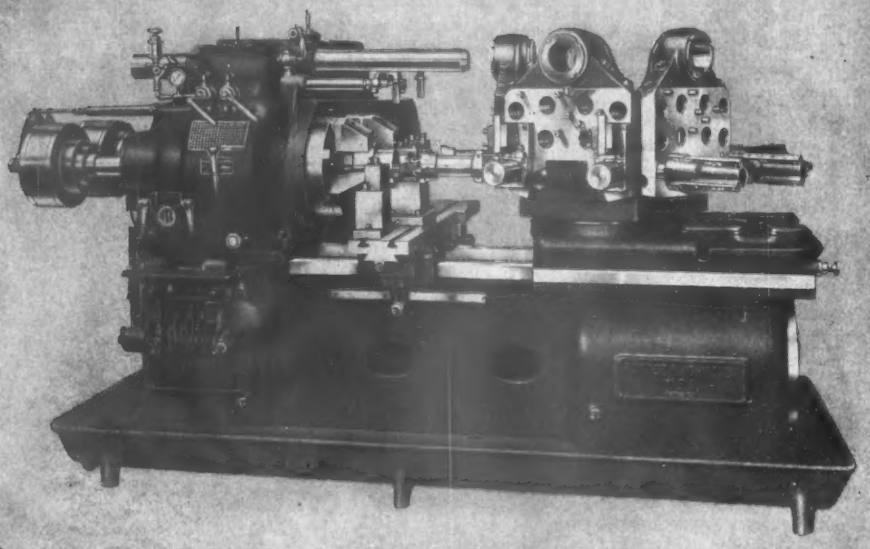
	No. of Pieces Between Refittings	*Hours Required to Refit Die*
C—Hot-Trimming Die for Wheel Support	Steel—2,500 Hard-Faced—7,500	Steel—16 Hard-Faced—8
D—Hot-Trimming Die for Steering Crank	Steel—1,750 Hard-Faced—7,500	Steel—16 Hard-Faced—8
E—Hot-Trimming Die for Front Wheel Support Arm	Steel—2,500 Hard-Faced—7,500	Steel—40 Hard-Faced—20
F—Upsetting Die for Pinion Gear	Steel—5,000 Hard-Faced—25,000	Steel—120 Hard-Faced—70



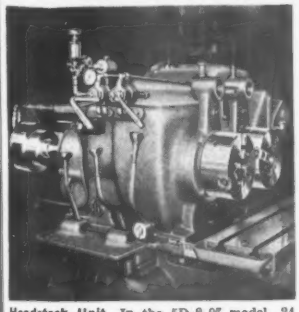
	No. of Pieces Between Refittings	*Hours Required to Refit Die*
G—Hot-Trimming Die for Steering Cross Shaft	Steel—3,500 Hard-Faced—15,000	Steel—28 Hard-Faced—10
H—Upsetting Die for Pinion Gear	Steel—5,000 Hard-Faced—25,000	Steel—120 Hard-Faced—70

Red-hard, wear-resisting alloy of cobalt, chromium, and tungsten.

"Haynes Stellite" is a registered trade-mark of Haynes Stellite Company.



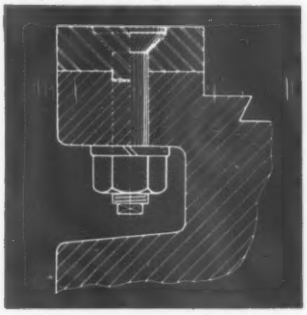
P & J 5D 2-9" 2-12" E2-15 POWERFLEX



Headstock Unit—In the 5D-2-9" model, 24 speed changes between 27 and 615 R.P.M. are provided; in the 5D-2-12" and 5DE 2-15", there are 28 changes of speed.

Automatic Speed and Feed Changes—These Power-Flex automatics are provided with power operated automatic clutches under dog or hand control. Feed and speed may be changed while cutting.

Cross Slide Unit—Adjustable longitudinally on bed ways so that slide can always be kept in correct relation to work in chuck or spindle nose fixture.



Steel Ways—Hardened and ground and applied to bed and turret slide—a construction that assures permanent alignment of spindle and turret—a development pioneered by P & J.

A 2 SPINDLE HEADSTOCK CONTRIBUTES TO LOWER PRODUCTION COSTS . . .

This P & J machine is designed to meet production demands beyond those possible from a single spindle unit.

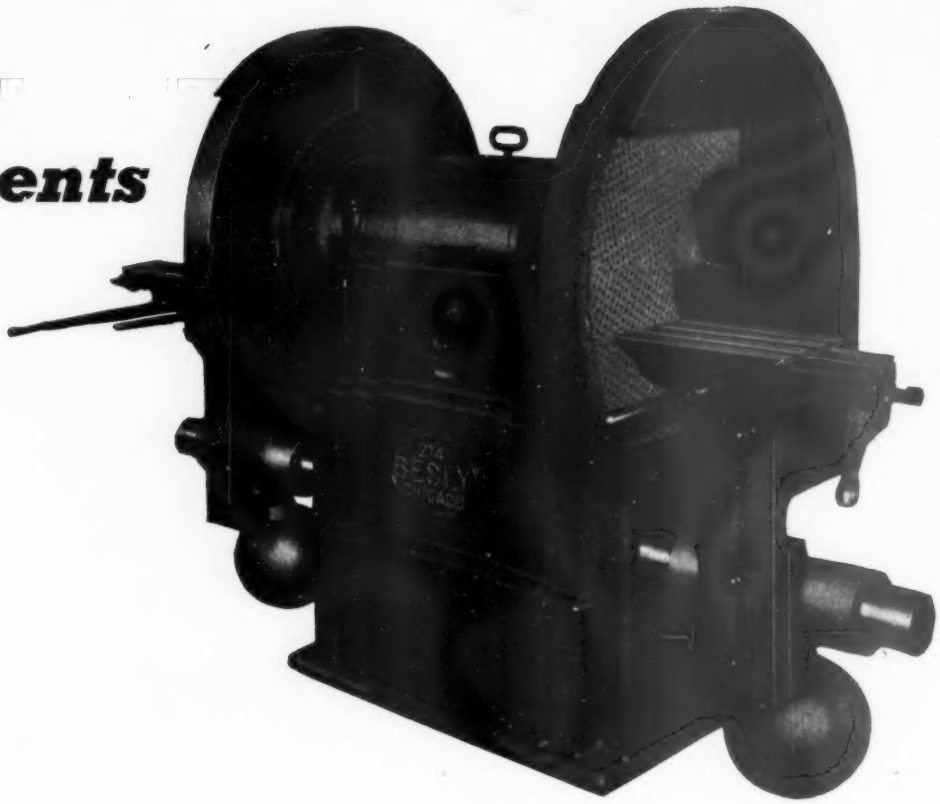
As in all P & J machines, outstanding features are offered which assure great flexibility, high production capacity, accuracy and operating convenience.

The 5D Power-Flex two spindle models are a logical modern development of the single spindle design and have proved their brilliant, cost-cutting performance in many branches of the metal working industry.

Complete details will be found in Bulletin No. 111, a copy of which is yours for the asking.

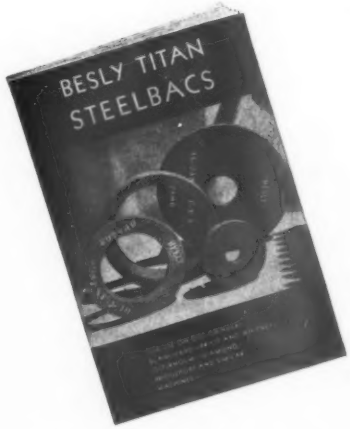
POTTER & JOHNSTON MACHINE COMPANY, PAWTUCKET, R. I.

Besly *Presents*



The Disc Grinder with real production possibilities. This massive rugged Besly Grinder turns out work at an amazing rate. Equipped with Besly Titan (Bolted-On) Steelbac Abrasive Discs, forty inch diameter, two or three inch thick. Served by Geared Lever Feed Tables with 20 to 1 ratio. Can you visualize its capabilities? The Wheel Collars are twenty-two inch diameter—Rockershaft carrying the Tables four and one half inch—Spindle almost four inch where it is mounted on highest grade Ball Bearings. It will effect wonderful economies and increase production in your plant. Its 25 H.P. Totally Enclosed Fan Cooled Ball Bearing Motor transmits power to spindle through eight Vee Belts. Heavy Welded Steel Hoods protect the operator. Built also in smaller sizes with Abrasive Discs down to 18 inch diameter. All these Besly Grinders remove stock with astonishing speed and the improved grinding members (Besly Titan Steelbac Abrasive Discs) effect marked savings in abrasive costs.

Get further details on what the modern Besly Grinder will do for you.



Write for your copy of Booklet on Besly Titan Steelbacs.

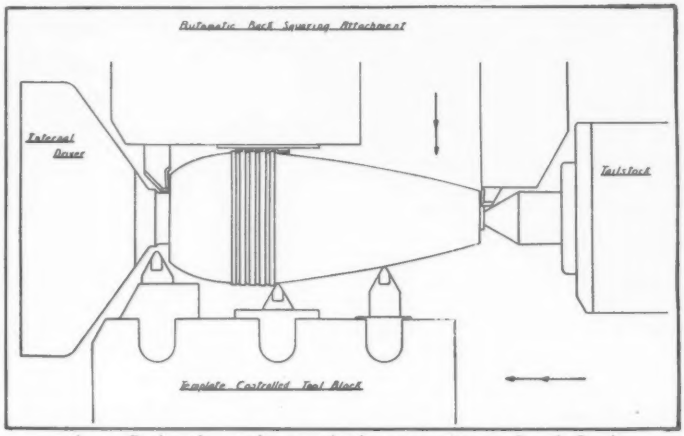
CHARLES H. BESLY AND COMPANY

118-124 NORTH CLINTON STREET ★ CHICAGO, ILLINOIS

MACHINE OF THE MONTH

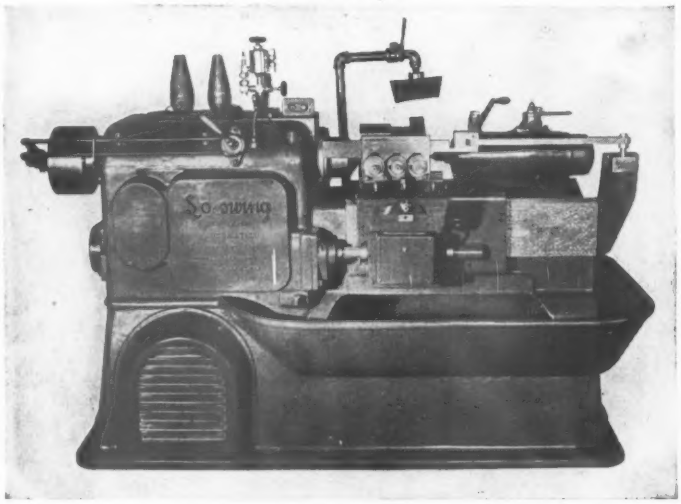
PREPARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK

BOMBS COMPLETELY FINISH TURNED FROM ROUGH CASTING IN ONE OPERATION ON MODEL "U" *Lo-swing*



Above: Tooling layout for completely turning 81 mm Brandt Bomb in one operation.

Below: One of the Model "U" Lo-Swing automatic lathes used on this job.



When these 81 mm Cast Iron Brandt Bombs are placed in the lathe they are rough castings, centered on the closed end only. The operator, who handles two machines, presses the starting button and this full-automatic Model "U" Lo-Swing finish turns, faces and grooves them completely ***in one operation.*** No other turning is required.

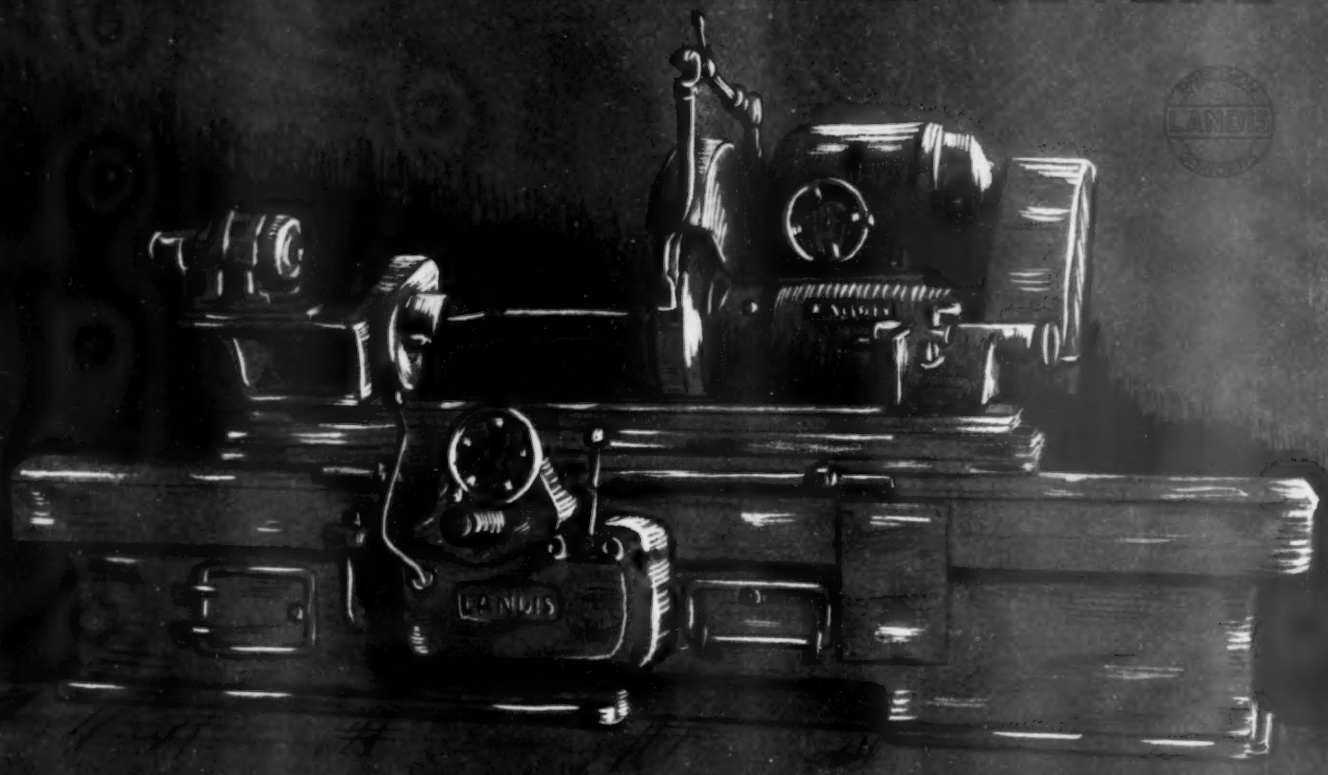
The work is chucked from the rough bore with an expanding jaw driver. A special Multiple Taper Attachment Block on the front carriage, consisting of three template-controlled tools, turn the OD. The two outside tools on the Back Squaring Attachment face both the open and closed ends of the bomb. The remaining tools, held in a magazine-type tool block, move in simultaneously to cut the grooves.

All tools are cemented carbide. Production is 56 finished bombs per hour at 85% efficiency. Spindle speed 232 R.P.M. with a feed of .020".

Many Model "U" Lo-Swing Lathes are rendering outstanding performance on this class of work, after having thoroughly demonstrated their economy and efficiency or shaft work, pistons, bushings and other short cylindrical work. Your inquiries are invited.

LATHE NEWS from SENECA FALLS

WHEN DEMANDS ARE SEVERE



CONSIDER THE LANDIS TYPE-D PLAIN

It is not only work of considerable size and weight which requires a grinder having plenty of stamina. Many smaller parts, to be handled economically, must be ground on such a machine. No better one could be found than the Landis Type D Plain Hydraulic. Look at the listing below to see why it will meet severe demands.

• Consistently rapid stock removal up to 2 cu. in. per minute with the 25 H.P. wheel drive motor.

• A 30" diameter wheel up to 6" face or a 24" diameter wheel up to 12" face may be used.

• Either a 36" or a 42" diameter wheel may be supplied instead of the standard 30".

• Multiple wheels may be mounted on the spindle nose or, if the span is too great, between the wheel spindle bearings.

• With the aid of roll heads and an equalizing drive, small straight face rolls may be roughed and then finished to the highest possible degree.

Ask us to show you a Landis Type D in operation the next time you need a grinder that will "take it" without giving in under the strain.

369

LANDIS

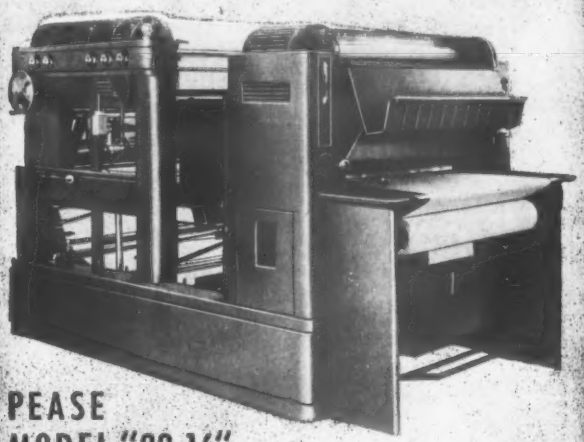
WAYNESBORO *Tool Company* PENNSYLVANIA

Good BLUEPRINTS

ARE JUST ABOUT THE MOST IMPORTANT COG IN

MASS PRODUCTION

In peace or in war, mass production depends upon fast, permanent, contrasty, low cost reproductions of engineering drawings . . . good blueprints made on Pease machines are the answer . . . The proof is there are more Pease machines in use than all other makes combined.



PEASE MODEL "22-16"

Makes Blueprints *faster*—20 feet per minute . . . *better*—deep blue background, sharp white line prints . . . at *lower cost*—due to these exclusive, outstanding features . . .

★ **Sliding "Vacuum-Like" Contact** smoothes out tracing inequalities, gives 24¾" uninterrupted exposure area and, for example, prevents printing a "3" as a "9." ★ **Three Speed Lamp Control** allows the lamps to be operated at 10, 15 or 20 amperes, doing away with running speed and dryer heat changes. ★ **Actinic "No-Break" Arc Lamps** burn for 45 minutes without a break and resume instantaneously. ★ **Horizontal Water Wash** floats prints free from tension, prevents wrinkles and eliminates stained prints and virtually all bleeding. ★ **Quick Change Chemical Applicator System** allows change from Blueprints to Negatives, or vice versa, in 30 seconds, and provides only method of applying potash to one side of paper, thus eliminating yellow stains. ★ **Aluminum Drying Drums,** five 8" diameter drums thermostatically controlled, heated either by gas or electricity, allow gradual drying, resulting in "prints as flat as hung wallpaper."

Model "22-16" is made in 42" and 54" sizes; write for descriptive literature. Pamphlets on lower capacity Pease Blueprinting Equipments will also be sent upon request. No obligation.

THE C. F. PEASE COMPANY

2657 WEST IRVING PARK ROAD

CHICAGO • ILLINOIS

Pease Blueprinting Machines

A TYPE AND SIZE FOR EVERY REQUIREMENT INCLUDING DIRECT PROCESS PRINTING

SUNNEN PRECISION HONING MACHINE

TIME CUT FROM
20 minutes to less than 1 minute

COST CUT FROM
20c to 2.8c

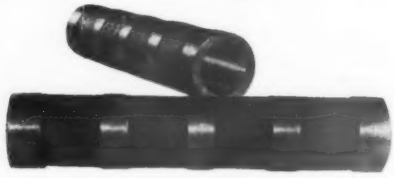
A manufacturer of hydraulically operated dump bodies was taking 20 minutes to lap a valve body at a cost of 20c each. The Sunnen Precision Honing Machine now does the job in less than a minute at a cost of 2.8c! Naturally the Sunnen Precision Honing Machine can't show such sensational savings on all jobs but it is helping hundreds of manufacturers to economically produce more accurate holes with better surface finishes. What's your problem? Why not tell us about it?

Miniature Model Airplane Cylinders "Eliminates expensive machine set-up."

Stone Lettering Air Hammer "Sunnen honing does in five minutes what it took 20 minutes to do by lapping."

"Produced an extremely accurate and glass-like finish."

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 in."



"A perfectly straight round hole with a mirror finish."

Drill Jig Bushing "Increases sales appeal of product."

"Strict alignment maintained between two holes."

Drawing and Blanking Die "Saves time in producing smooth base metal finish."

Rubber Eraser Extrusion Die "Tripled life of extrusion dies."

Inner Bearing Ring "Accurately removes last 'tenth' of stock."

- **Immediate Delivery**
- **Low in Cost**
- **Easy to Use**
- **Economical**
- **One-Minute Set-Up**

Accurately sizes and finishes internal cylindrical surfaces from .185" to 2.400" in diameter! Produces super-smooth surface finish. Accuracy within .0001" guaranteed.

Does not require skilled, experienced operator — any intelligent workman with a few hours' practice can produce precision workmanship.

Used in hundreds of plants — particularly by manufacturers engaged in the defense program.

A Sales Engineer will be glad to call and demonstrate this machine in your plant. Write for FREE 8-page bulletin.

SUNNEN

SUNNEN PRODUCTS COMPANY 7932 Manchester Ave., St. Louis, Mo. • Chatham, Ontario

When your bottleneck is

LOW AIR PRESSURE—

Break it with High-Cycle! That's what we did at this foundry. Did it *quick* and at *little cost.*

Pressure down to 50 lbs. I placed a gauge in the line *at the tool* (tank gauge readings don't count with me). Pressure was only 50 lbs. when tools were running. Piece output was below par. Slow speeds made wheel life short. Cost of additional compressor—$2477 (plus cost of air tools) would have been excessive. High-Cycle was the logical answer for their Defense work needs—faster production with low investment cost.

Out of the jam for $905. Pinched for funds, and in need of immediate delivery, they bought a used frequency-changer for $425. Four new Rotor High-Cycle Grinders cost $480. Later they bought two more. They have enough power to handle four more tools if required. By now using fewer air tools, air pressure is up and they're getting higher output from them, too.

There's nothing mysterious about High-Cycle. Let me demonstrate it in your shop. No obligation. Perhaps it will break *your* bottleneck. Or perhaps modern *Air* tools would be better in your case. I'm unbiased.

THE ROTOR ANALYST

Rotor High-Cycle tools operate faster under load—remove more metal per minute. Why? See Page 4 of the High-Cycle FACTS Book. Gratis on request.

The Rotor Analyst has 65 different Air tools and 99 different High-Cycle tools with which to solve your problems.

THE ROTOR TOOL CO.

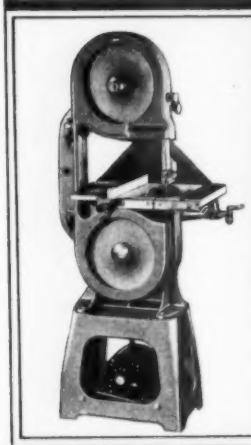
CLEVELAND, OHIO

AIR

HIGH CYCLE

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

Engineered for To-day's Increased Production



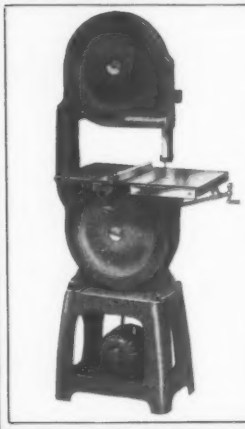
16 INCH BAND SAW

For wood or metal cutting in tool room, pattern shop, especially valuable for aircraft plants.

This saw was not built to meet price competition but was built to the highest possible standard for production work. All adjustments are made from front of saw. Has one piece guard hinged for quick access to blade adjustment. Table tilts to 45°. Capacity-blade to frame 16"; cuts material up to 10⅝". Electric light is built into guard.

15 INCH BAND SAW

A new saw to serve the same purposes as the 16" Band Saw, it is also built to the same rigid requirements. It features the same concave roller guides mounted on Ball Bearings. Both have one piece cast iron hinged guards; one piece cast iron frames; rigid cast iron upper wheel mountings. All adjustments are practical and unnecessary gadgets have been eliminated. Cuts to center of 30" panel up to 6⅞" thick.



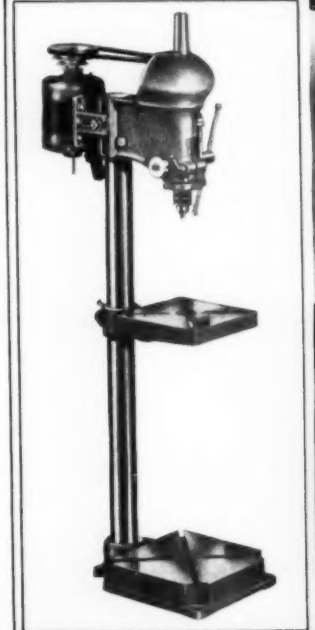
MULTIPLE SPINDLE DRILL PRESSES

Supplied in two or four spindles for industrial work. Featuring all New Departure Ball Bearing construction, heavier head castings and superior construction throughout, these Drill Presses will be found in the largest manufacturing plants to relieve heavier equipment and speed up drilling and tapping operations. Equipped with 0-½" Jacobs Chucks. However, the extra heavy construction is designed for full ⅝" capacity in steel. Equipped with counterweights, belts and motor pulleys. Two Spindle Press has table surface 19¼" x 29". Four Spindle Press table is 20½" x 50". Distance between spindles is 12" with 7" from chuck to column. Maximum distance chuck to table is 26".

DURO

The machines illustrated are exemplary of Duro Production Power Tools. Acknowledged as America's Finest and Most Complete Line of Power Driven Machines, there is a size and type to fit many needs. They are in modern design, precise in workmanship and built of the finest materials to give greater values.

Now is the time to buy Duro Tools. They lend themselves to many jobs. They will help you maintain or speed up your production schedules as they have for many other manufacturers. Now is the time to send for catalog E-41-A. Mail us a card today. We will send your copy by return mail. If you have any problems, we'll be glad to help if you'll write our Power Tool Service Department.



BALL BEARING DRILL PRESS

Featuring the same heads as are supplied on the multiple spindle presses. Supplied in either Bench or Floor models for single spindle operation. Invaluable for their ease of portability from Department to Department to relieve extra production loads.

Two large New Departure Bearings support the spindle in the quill. The spindle pulley is independently mounted also on two New Departure Ball Bearings — this mounting is an integral part of the head casting eliminating possible wear on inserted mountings.

ROUTER SHAPER CARVER

A three purpose machine incorporating power, high speed and vibrationless operation. Power is supplied by General Electric Universal Motor developing over 1200 watts output. Spindle is mounted on New Departure Precision Ball Bearings and runs at approximately 20,000 R.P.M. Routing, Shaping or Spindle Carving can be done with equal ease and at less cost for equipment than would ordinarily be paid for a single machine. Equipped with all adaptors and wrenches for all operations.

DURO METAL PRODUCTS CO. DEPT. PT-1, 2649 N. KILDARE AVE., CHICAGO, ILL.

ABRASIVE WHEELS

Serve the Nation!

Perhaps unheralded as an important tool for national defense, nevertheless, abrasive wheels play a prominent part in the manufacture of many types of war materiel. The many efficiencies of grinding as a means of working metal parts have long been recognized by private industry and these principles are now being advantageously applied to the requirements of the defense industries.

Abrasive Company Grinding Wheels are serving the nation by their efficient performance on a wide variety of grinding operations, typical of which are cylindrical grinding gun barrels for anti-aircraft guns . . . grinding crankshafts for airplane engines . . . rough snagging foundry castings for tanks and trucks . . . cutting-off airplane tubing with abrasive cut-off wheels . . . and many, many others.

All metal-working plants can benefit by using Abrasive Company Products. Our manufacturing facilities are geared to the demands of the defense industries plus those of normal industrial production. Interested production executives are invited to send for copy of our photographically illustrated picture book showing the size and scope of our organization and our ability to take care of your abrasive requirements.

AMERICAN DEFENSE COMES FIRST

ABRASIVE COMPANY

Division of Simonds Saw and Steel Company, Tacony and Fraley Sts., Philadelphia, Pa.

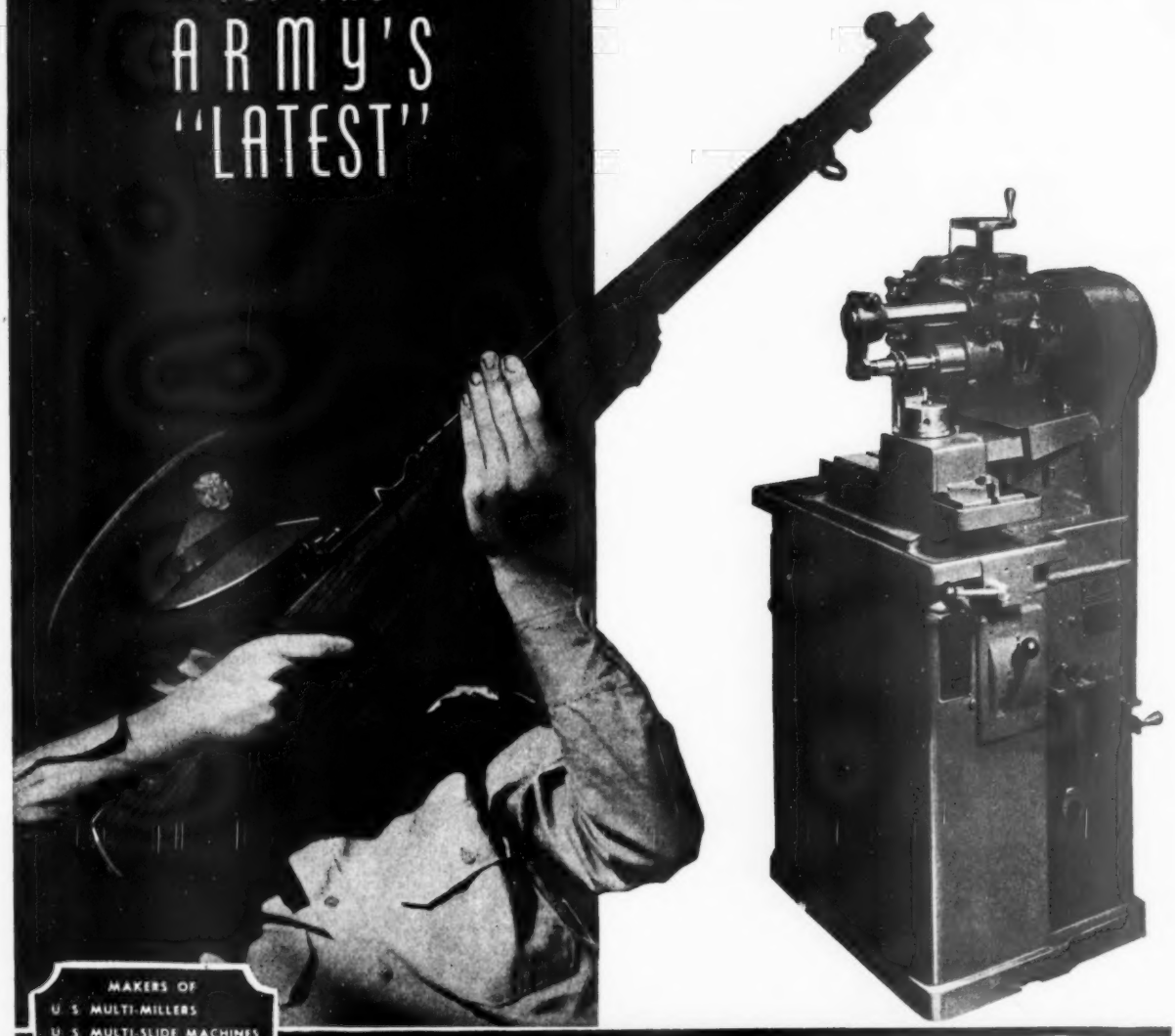
ELECTRIC FURNACE PLANT: ARVIDA, QUEBEC, CANADA • CHICAGO BRANCH: 127 S. GREEN STREET

DISTRIBUTORS IN ALL PRINCIPAL CITIES

Manufacturers of Abrasive Grinding Wheels under the trade mark names BOROLON (aluminum oxide) and ELECTROLON (silicon carbide)

U. S. MULTI-MILLERS BOOST small-part production for the ARMY'S "LATEST"

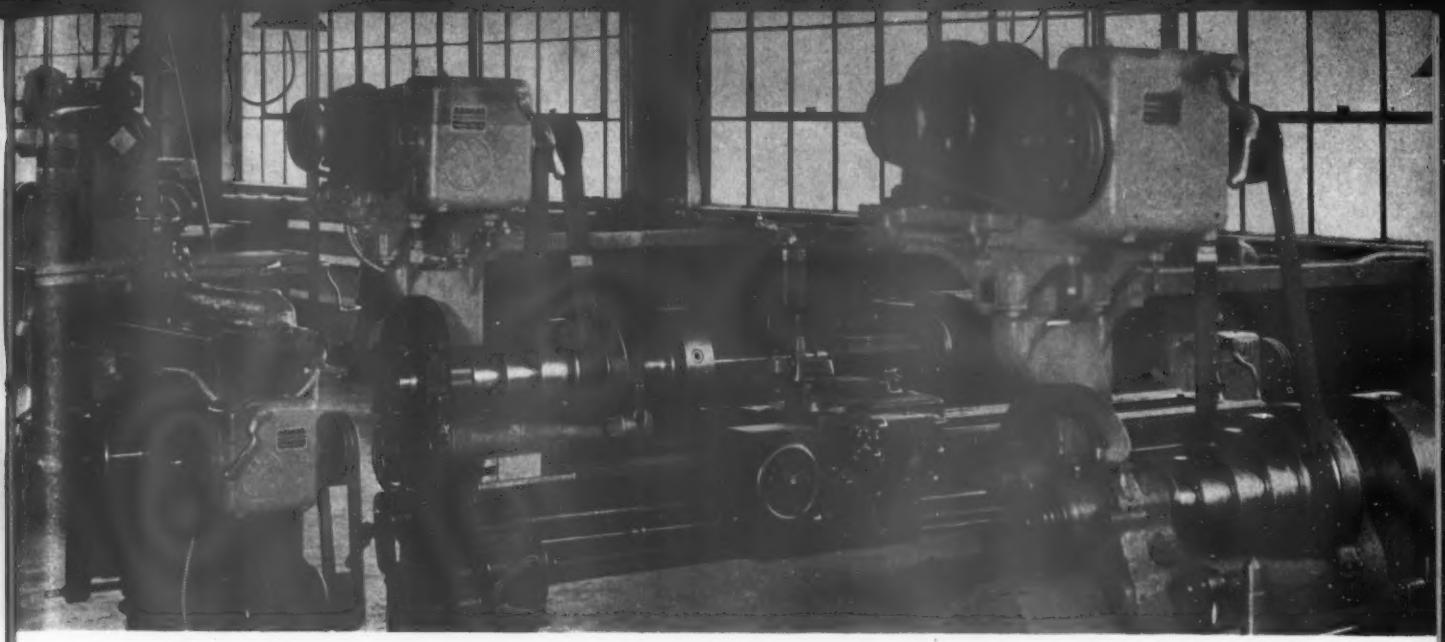
IN important gun factories, U. S. MULTI-MILLERS are speeding up the production of many of the vital parts of the Army's new Garand Rifle. On jobs like these, where intricate cuts must be taken on small parts, U. S. Multi-Millers offer a practical method of attaining high precision plus high quantity production. Designed solely for efficient small-part production, built to perform *automatically* all sorts of milling, grinding and cutting-off operations, the U. S. Multi-Miller is helping manufacturers of rifles, machine guns and many other types of ordnance to meet the "speed-up" in National Defense preparations. Write for our illustrated bulletin MT-40, describing its features and possibilities in full.



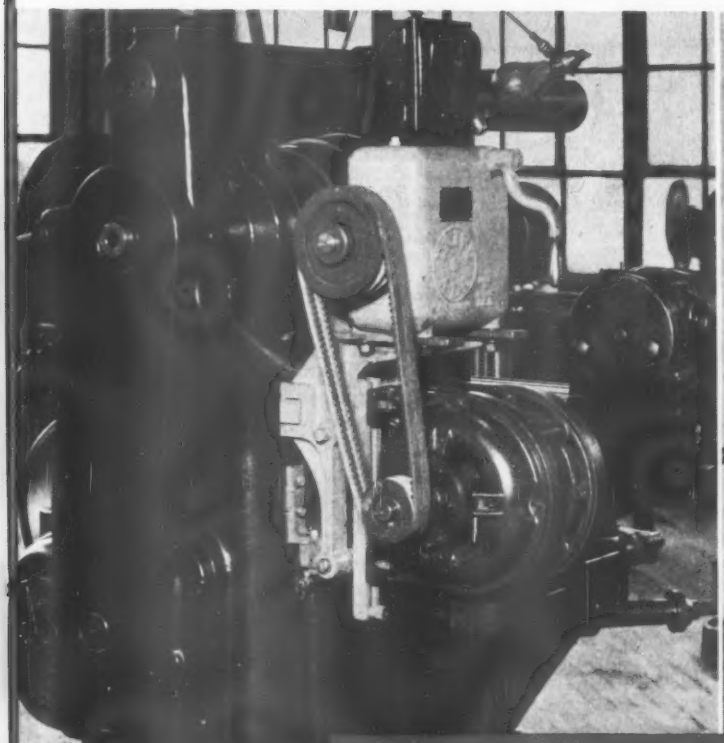
MAKERS OF
U. S. MULTI-MILLERS
U. S. MULTI-SLIDE MACHINES
U. S. AUTOMATIC PRESSROOM EQUIPMENT—U. S. COMPOUND WHEEL TRUING ATTACHMENT
U. S. DIE SETS

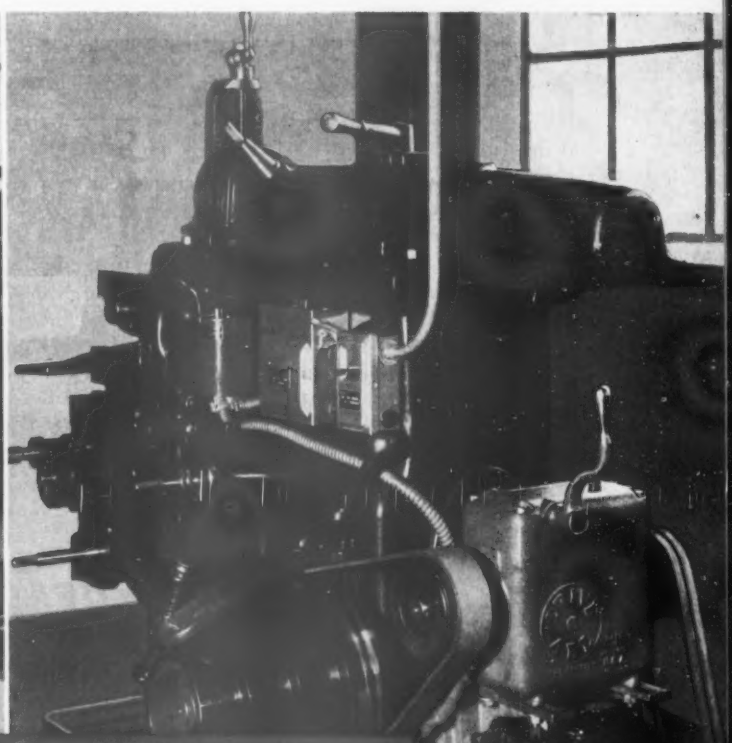
U.S. TOOL COMPANY, INC.
AMPERE, (EAST ORANGE,) N. J., U.S.A.

PRODUCTS



DRIVE-ALL

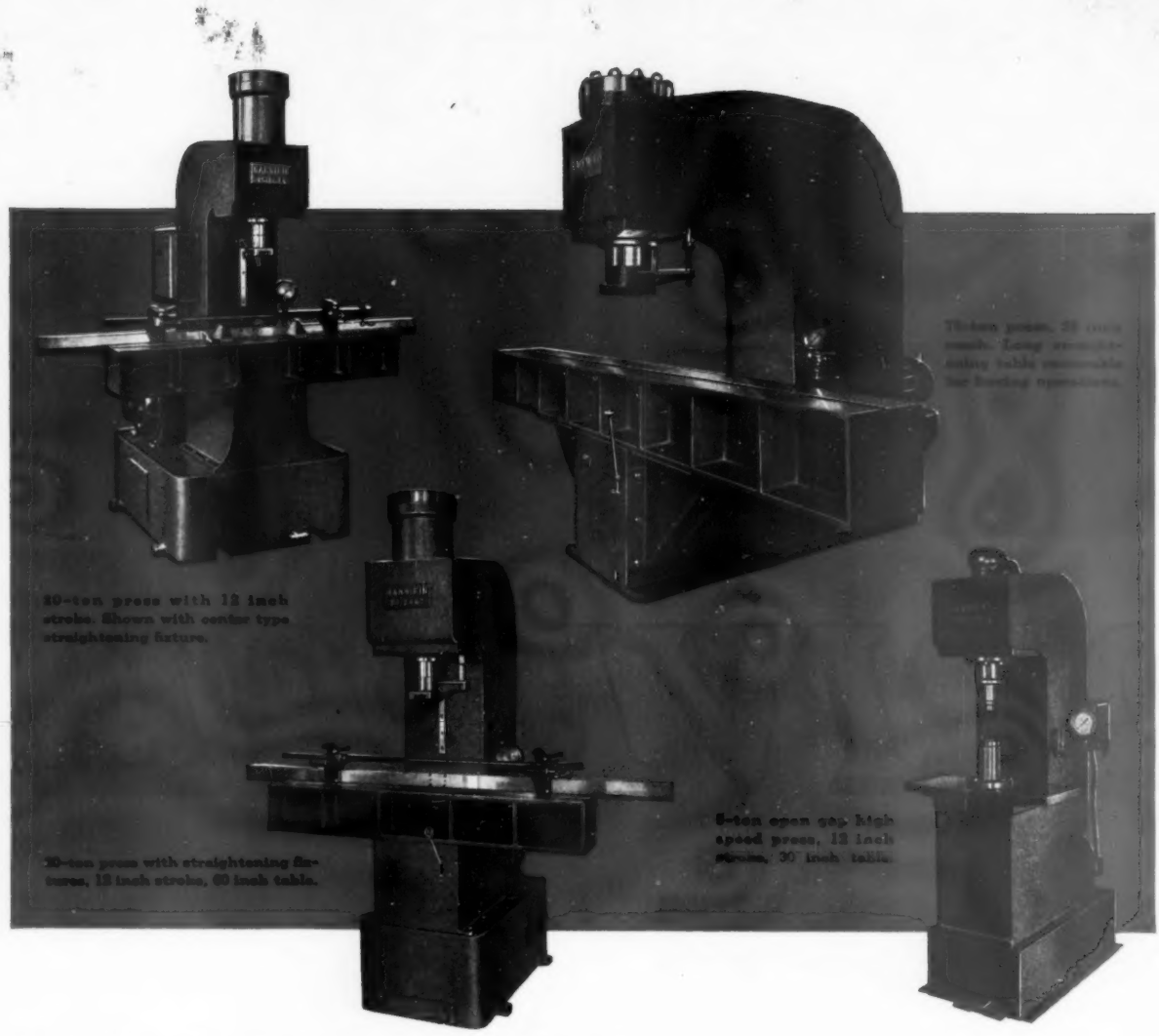




MANUFACTURED BY

DRIVE-ALL MANUFACTURING CO.

3400 Conner Ave. Detroit, Michigan



PRESS PERFORMANCE *that can help you now*

Hannifin Hydraulic Presses deliver fast, easily handled production on press-fit assembly, straightening, and any similar work involving the application of pressure.

The exclusive sensitive pressure control provides infinitely variable ram pressures, from a few pounds to full capacity, with a single finger-tip control lever. Rapid handling and improved accuracy are natural results from this simple and sensitive control.

Hannifin Hydraulic Presses in standard sizes (5, 10, 15, 20, 35, 50, 75 tons) are promptly available. Hannifin construction, with welded steel frames, built-in hydraulic power, and sensitive pressure control, permits flexibility in design to meet your individual needs. Table construction, gap, reach, and ram stroke are readily modified to adapt the performance to your production. Ram stroke is adjustable to avoid unnecessary up-travel of ram.

Consult Hannifin engineers for detailed recommendations, or write for press bulletins with complete specifications.

HANNIFIN MANUFACTURING COMPANY

621-631 SOUTH KOLMAR AVENUE, CHICAGO, ILLINOIS

Detroit representative: R. A. Bean, Hayward Building, 4829 Woodward Ave., Telephone Columbia 4949

HANNIFIN Hydraulic Presses

IT was raining in Washington.

The night gave way reluctantly to a murky half light as the city stirred itself. The rain, a steady downpour on the wide pavements, puddled where the last remnants of snow clogged the drains. Every awning and marquee collected its quota of unhurried pedestrians.

The morning buses were crowded with clerks hurrying to their work in the Federal Reserve Building, in the Treasury Building, in the Commerce Building—where filing cabinets and clerks overflowed into the wide corridors.

Down at the Naval Gun Factory traffic jammed at the approach to a bridge over the Anacostia river. In the Administration Building Chief Planner Davies pondered the problems of expansion; aides worked busily at reports pink-slipped "urgent"; two men bent over curling blueprints.

In the slums near the capitol the rain churned bare yards into slush; no gossip floated over back fences.

Along New York Avenue proprietors opened their stores and cocked a disgusted eye at the customer-chasing sky.

In his large, bare office atop the modernistic Social Security Building on the south side of the Mall, Production Chief Knudsen received word that he would be needed next day for newsreel photographs on the labor registration drive; muttered at this interruption of his work. Downstairs, on the unfinished third floor, where temporary telephone wires wove a spidery web among the chandeliers, the harried staff of the information division worked in partitionless offices. Across the hall, in the tiny library, more material was wheeled in for study and filing.

An old negro labored up a long flight of steps, walking on wooden boards put down to protect the marble, and teary-eyed gazed at the understanding Lincoln.

It was Tuesday, March 11, 1941.

By noon, when Speaker Rayburn called the House of Representatives to order, the rain had stopped. In the cream and azure Coffee Shop of the Willard, men

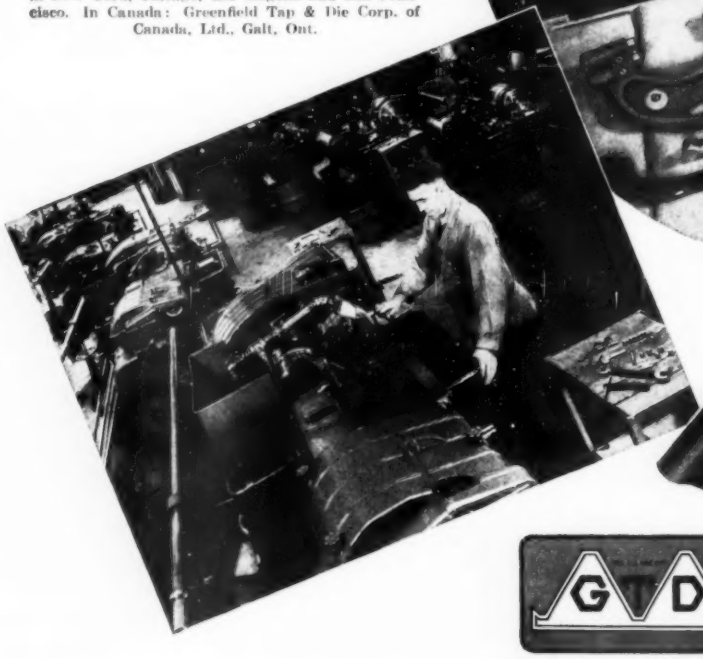
We know the importance of GAGES from experience

Nearly fifty years ago Greenfield Tap & Die Corporation began to manufacture gages—because the open market didn't afford the accuracy and reliability we required. Today all our manufacturing operations are checked with the proper gages.

The recognized accuracy and reliability of "G.T.D. Greenfield" Gages has resulted in the present country wide demand for them. Our Gage Division — already one of the largest in the country, will be more than doubled when present construction is completed. We shall continue to build the best gages that can be made, and to further expand our gage engineering service.

GREENFIELD TAP & DIE CORPORATION
Greenfield, Massachusetts

Detroit Plant: 2102 West Fort Street. Warehouses in New York, Chicago, Los Angeles and San Francisco. In Canada: Greenfield Tap & Die Corp. of Canada, Ltd., Galt, Ont.



GTD GREENFIELD

TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOLS

bent over tables and conversed in low tones. In the long, classic corridor upstairs a man with tired eyes was dictating to a young woman sitting on a lounge beside him.

Away from the bustle of Pennsylvania Avenue, White House Callers lunched at the swank Carlton. Far across the city, Major General Wesson paused in the Army Ordnance reception room to look down through a glass panel upon a crowded drafting room; paused momentarily again to banter with a secretary.

There was bantering in the House of Representatives, too.

Members wandered about, talking and laughing, as Speaker Rayburn repeatedly banged for order.

The House quieted as Joseph Martin rose to speak: "We have taken a step unparalleled in American History. There is danger at every step we take from now on. All of us, no matter which side we may have supported in this historic controversy, pray fervently that the decision is a wise one and that it will preserve peace and security in our country."

When he concluded, the entire House rose and applauded. However, the chamber dissolved into chaos again as member after member rose to explain (for the benefit of his constituents) that his vote was for the amendments, not the act; there were repeated cries of "Vote, vote."

By three o'clock the clouds were breaking up. In the White House six pens were laid out upon the desk in the executive office of the President.

On Capitol Hill, Vice President Wallace left his office and crossed to the other wing of the Capitol. There, in Speaker Rayburn's office, he signed the historic parchment. A clerk in the House announced that Speaker Rayburn had signed, indicating House passage.

A few minutes later a special messenger sped down Pennsylvania Avenue to the White House: in twenty minutes the Lease-Lend bill was law.

THAT night many Washingtonians worked late in their offices; crowded the Pall Mall Room at the Raleigh; listened to Irish Ballads in the Hi-Hat Room at the Ambassador; filled the dusty old Earle Theatre; did all of the things Washingtonians were wont to do.

Yet there was a difference.

Beneath unconcern and cynicism, beneath work and play, beneath the tinsel-cheap chatter in night clubs as beneath the surface of conversation in the embassies out Massachusetts Avenue, there lurked a knowledge of the importance of the thing which had happened: after years of vacillation, after months of debate and delay, after a period of terrible indecision America had cast her lot, completely and irrevocably, with the British.

Technically America was at peace.

But this was a decade of undeclared war. Technically Japan was at peace with China. Technically Italy had been at peace with Ethiopia. Technically Germany had been at peace with her neighbors until long after many of those neighbors had been gobbled up.

In the face of a reality such as war, technicalities meant nothing.

Washington knew this, and all America knew it.

The only reason that the issue had been confined to the inanimate material of war was that human material was not needed. This was a war of production, a war of attrition, a war of rival efforts to wipe out enemy factories; to starve out and bomb out enemy morale. It was war in which, as yet at least, the soldier was an individual of relative unimportance.

The role which America had accepted was the role of an arsenal. Stripped of technicalities the bare fact stood revealed:

America was at war.

SINCE that Tuesday night in early March, the scene has shifted from Washington. It has shifted to the industrial flats of New Jersey. It has shifted to Radford, on the red banks of the New River, in southwest Virginia. It has shifted to Detroit, where machinery is moving into the Chrysler Tank Arsenal and where an outer shell has protected construction on the Ford Aircraft Engine Plant from the ravages of winter. It has shifted to Canton, to Louisville, to St. Louis, to Omaha, to Los Angeles.

And it has shifted from the legislator to the engineer.

For as this is a war in which the soldier is relatively insignificant, it is a war in which the engineer is supremely important.

Important is the research engineer as he seeks new means of destruction; important is the designing engineer as he converts ideas into blue prints; important is the Tool Engineer as he converts blue prints into production.

By and large the era of initial decision and contract letting is past. America has made up her mind and, typical of America, has thrown the problem into the laps of the Tool Engineers, considering it done.

But it is not done.

And as Tool Engineers tackle the problem they seek to use every means at their command. They draw upon the collective ability they have acquired in mass production for progress, in order to evolve a new mass production for destruction; to be used against an element which democracy has judged to be a threat to that progress.

They were busy enough when their task was one of defending America tomorrow. They are faced with one of the most incomprehensible tasks of all time as they undertake, in addition, to defend Britain today. They know that theirs is more than a task of making the America of tomorrow.

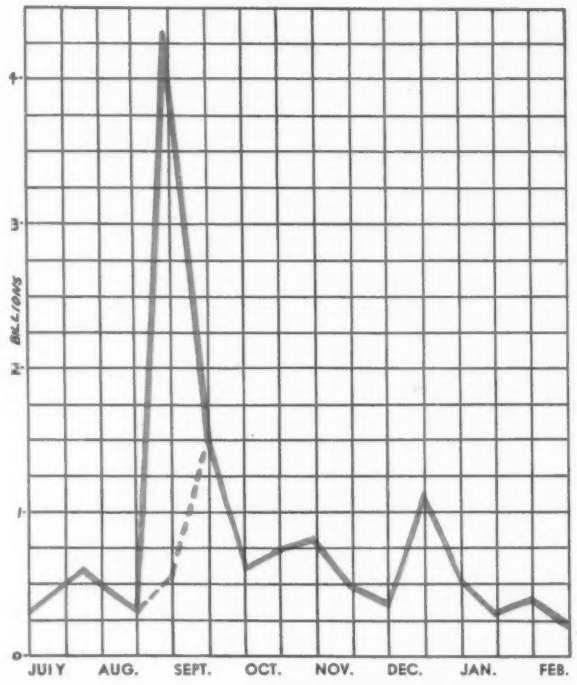
They know that upon how well they perform this task will depend the future liberty and progress of the World.

This Study is in Four Parts

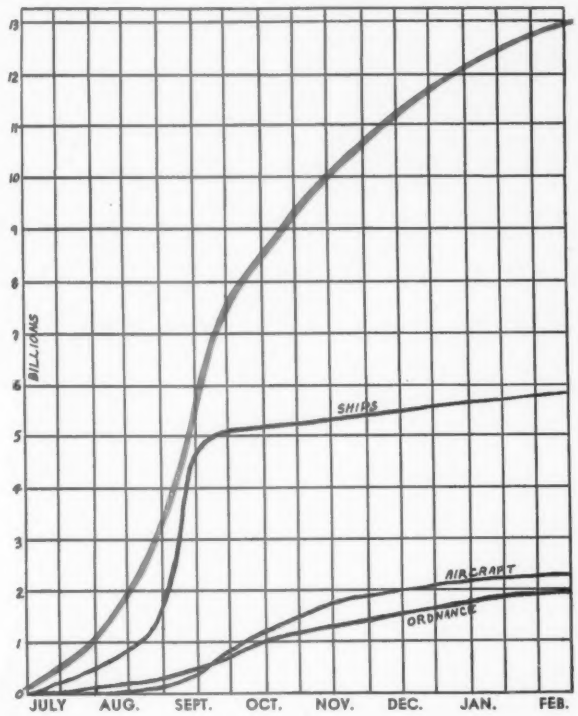
BEFORE making a study of the problems of defense, and the tremendous tooling program involved, let us look at the figures in an effort to see the magnitude of the problem faced. The analysis on the following page is largely the responsibility of THE TOOL ENGINEER. It is based upon contract figures released by the Office of Government Reports and other reliable sources. It is intended merely as a means of giving the reader perspective as he proceeds into the issue proper.

We have divided our study into four parts. In Part I the problems of changing from a peacetime to a wartime economy are examined. In Part II the requirements of aircraft—modern warfare at its mightiest—are considered. In Part III the broader requirements of ordnance for the Army and Navy are analyzed. And finally, in Part IV, the basic requirements of educating men to fill our expanding industry are given, and two solutions which have worked are presented.

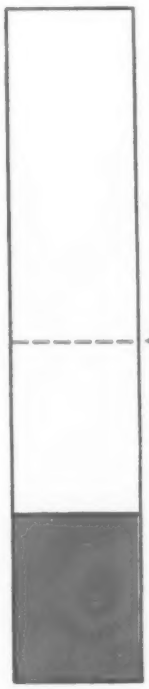
The Cost of Our National Defense



The graph directly above indicates the fortnightly expenditures on our Defense Program from July, 1940 through February, 1941. The dotted line shows the course the curve would follow if the purchase of a two ocean navy early last September is omitted. Observe a tendency of the curve to drop down as the spending program apparently drops off. This is borne out by the cumulative graph at right which shows how expenditures are tending to level off. Note that



the purchase of actual fighting implements, (ships, aircraft, ordnance) are leveling off at a sharper rate than the total expenditures (red line). The normal running expenses for supplies and materials account for this difference.



HOW MUCH

ARE WE

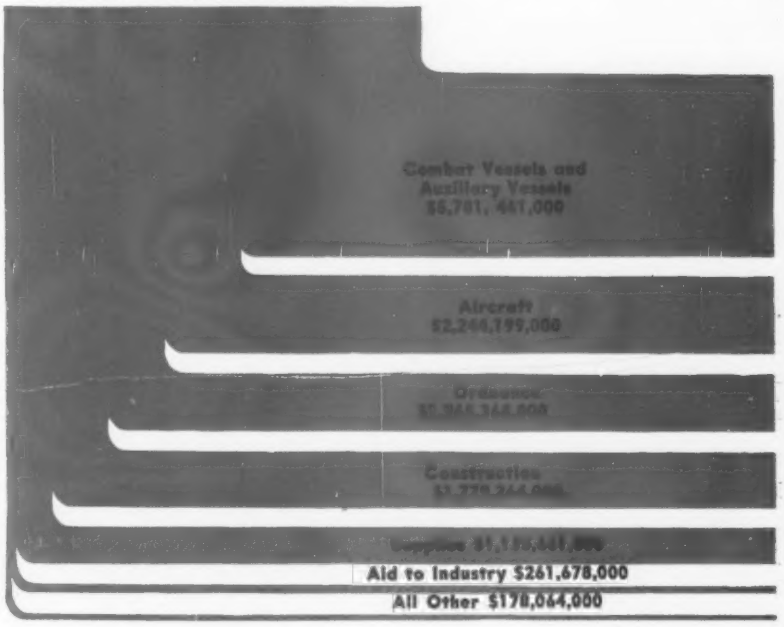
SACRIFICING?

ENGLAND TODAY

The bar at left indicates the total industrial production in America today. The red portion represents reliable estimates as to what proportion of this production we are turning to Defense Production—how much the nation is sacrificing, in other words. Compare this with the estimate of the extent of Great Britain's sacrifice as indicated by the red arrow.

Defense Money Spent Has Bought:

Total to February 28—$13,345,695,000



PART I

PEACE AND WAR

CHANGING a nation from a peacetime to a wartime status involves many serious problems. Such problems are the more complicated when that nation attempts, through the democratic process, to make the transfer without an open declaration of war.

America is destined to be the "arsenal of democracy". To accomplish this will require a wartime economy; but, as yet, America is unwilling to accept the role of a nation at war. Labor is still thinking more of its rights than of the production of planes; management is still more concerned with peacetime markets and commodities than with the construction of new plants, while consumers are still fastidious about the ersatz trim on their new cars.

By and large Americans are still primarily concerned with personal problems.

If this nation were technically at war, enthusiasm would whip up such a patriotic frenzy that personal problems would be forgotten in striving for the Great Goal. This month is one teeming with possibilities. It may be that before this month of April, 1941 is ended, these United States will be embarked upon another war.

Such a course, to some, may seem unnecessary. Our role of arsenal can as easily be filled under the present set-up, if we are willing to forget personal differences and pull together. We in America should be capable of the clear vision and horizon thinking essential to meet these problems unflinchingly and without resorting to the undisciplined mob psychology so generally associated with war.

The past decade has seen an emergence of class against class in the national scene. This now must be put away. The administration has reversed its policies and brought together many practical business men as its advisors in Washington. The President has resisted all efforts of their opponents to scuttle the work of these men. Industry and labor are going to have to adjust, if not entirely solve, their differences; industry is going to have to adjust its operations to guard against saboteurs; all of us are going to have to adjust our consumption so that it will not interfere with the production of war materials.

In Washington, men of widely divergent political philosophies are beginning to find ways of working together in reasonable harmony. If all of us—engineers, workers, executives, and politicians—can do that throughout America, we shall gain character as individuals and stature as a nation.

(Illustration—"Call to Arms" by Ewing Galloway)

Industry and National Defense

by E. M. SIMS
President, Metal Forming Corp., Elkhart, Ind.
Member National Defense Committee

There is no safe way of shortcutting the preliminary processes of research, design, tooling, and plant layout, but we can do them rapidly if we cooperate.

FROM the dim recesses of the prehistoric past down to the present day, man has continually multiplied his enjoyment of life's needs and satisfactions, beyond the limits of his own physical powers, by the creation of tools and the discovery and invention of new and improved aids to his productive capacity. It is not too much to say that the rise in the standard of living has closely followed and been largely dependent upon the rate at which these physical, chemical, and mechanical resources have been created and applied.

Machinery Takes to the Air
A 750 pound crankshaft starts on a 7000 mile journey from Chicago to Wake Island.

In this development, America has far out-distanced every other nation on the earth. We have attained preeminence because here the individual has been encouraged, under a system of Free Private Enterprise, to the largest exercise of his initiative and ingenuity. Under other political and economic forms, such as are now dominant in Europe and Asia, the mass mind is exalted and the individual submerged. Regimentation of the processes of thought ultimately leads to mental sterility. In this country the scientist and engineer, given the widest latitude for the free play of their genius, have made their unequalled contributions to human progress. This Machine and Tool Progress Exhibition, with its amazing display of methods, devices and machines, furnishes one convincing evidence of the superiority of the American system. You are deeply concerned, therefore, with the preservation of the American Way, which has fostered the development of so fine a contribution and has blessed us all with so large a share of life's satisfactions.

There is another factor which stimulates your interest and requires your expert service in the preparation for defense. To a far greater degree

than ever before, the means of defense must be mechanized. The aggressor nations have devised new engines of destruction that render former protective equipment and methods pitifully weak. The modern mechanical monster ruthlessly crushes any opposition, not equipped with modern defensive weapons to combat it. In this country we have the finest scientific, engineering, and mechanical talent in the world and we can be confident that the products of our genius, functioning within the framework of political

Defenseman Sims (2nd from left) With President d'Arcambal, Planner Davies, Chairman Bayliss.

and economic freedom, will equal and ultimately far surpass the best efforts of the totalitarian states.

Before I review with you the progress of industry in the defense program, I think it is appropriate that I should state industry's position with respect to war. Upon this question there have been wide-spread public misunderstanding and some actual misrepresentation. American industry is overwhelmingly opposed to war, except as it may be forced upon us as a defensive measure to protect our shores, our lives, and our institutions from a foreign aggressor. This attitude has been iterated and reiterated in resolutions of the Boards of the National and State Associations; in the statements of their officers before public gatherings and over the radio; and in the expression of individual opinion by industrialists.

At the Congress of American Industry in New York last December, Mr. H. W. Prentis, Jr., President of the National Association in 1940, summarized and reaffirmed the resolutions adopted on frequent previous occasions. He said in part: "Let me reiterate that American industry is fundamentally opposed to war. It knows the cruelty of war. It knows that war is waste. It knows that industry thrives on the arts of peace. It would in very truth help to 'beat swords into plowshares and spears into pruning hooks' because only by the production of more peacetime goods and services can it fulfill its real mission, namely the constant raising of the standard of living of all our people.

"Industry knows, too, that modern war presents a basic threat to representative self-government appalling to contemplate. Any nation that engages in modern war is practically catapulting itself into some form of totalitarian government—at least for the period of the emergency. If modern war be prolonged, the dislocations occasioned in industry become more and more difficult of adjustment to peacetime conditions. Hence, our entrance into war would in all likelihood result—unless we are extremely alert—in the emergence of economic controls on a national scale, which would gradually undermine and ultimately destroy the precious values of personal freedom which our forefathers fought to establish 160 years ago.

"If we are endangered, we must, of course, defend ourselves without stint or limit. Life, property, freedom —no sacrifice would be too great in the hope that, in the aftermath, we might again have the clear vision, national unity, and personal unselfishness to re-erect the temple of American liberty. But let us be on guard lest we be left ultimately with only the empty shell of what we are now arming to defend."

No Short Cut to Production

American industry sees in the world situation today a definite threat to our peace and security and recognizes the imperative necessity of preparing to defend ourselves. It has repeatedly pledged its whole hearted support to the national defense program. It is applying its genius for industrial organization to this enterprise and has moved swiftly and unitedly to undertake all the commissions assigned to it. The public has had difficulty in understanding the time factor involved in the production of new equipment and materials. Mass production of familiar items in huge quantities has become a commonplace and the people have expected industry to start almost immediately to turn out armaments and munitions in similar volume.

But there is no safe way of short cutting the preliminary processes of research, designing, tooling, plant development, and material assembly, which must precede the start of actual production. Before a tank can be built forty thousand drawings must be made. The construction of a battleship requires thirty tons of blueprints. For a modern heavy bomber plane, 213 different industries supply important parts, the raw materials for which come from 41 different states.

But in spite of the period of necessary preparation, the speed which industry has made toward its objectives has astounded those acquainted with the magnitude of the task. New buildings have gone up; new equipment has been produced and installed; materials have been assembled; and the finished product started on the way to perform its intended service in a surprisingly short time. Here in Detroit there are outstanding examples of the amazing efficiency with which industry has undertaken its job.

For months the major activities of the national, state, and local manufacturing associations have been devoted to the stimulation and coordination of defense production. During recent weeks the N.A.M., with the cooperation of the state associations, has been conducting a self-census to determine, in great detail, the nature and capacity of plant facilities and the extent to which they are now occupied with defense work. This survey is being conducted with the full ap-

proval of Mr. Knudsen, for whose use the results will be made available. Some 30,000 questionnaires were sent out. As yet only partial returns are in, but the percentage of replies received and the extent of the interest and information have been encouraging.

In an effort to determine trends, an analysis of the first 100 returns from a typical state was made. Of these 100 manufacturers, only 21 were engaged in filling national defense orders, either as primary or sub-contractors; 40 reported that they could expand production, the estimated possible increases ranging from 10 to 300 percent; twelve stated that they had company-sponsored training programs in operation.

A few items, taken at random from replies sent in by manufacturers in other parts of the country, will be interesting. A large brick company stated it could make 50,000 more bricks a day. The owner of an idle creamery plant said that his facilities could readily be converted to chemical manufacturing or processing. An owner of a button plant offered to make available the services of two expert die makers. A Laundry Machinery Company reported that in addition to supplying laundry equipment for destroyers and cantonments, it was machining parts, as a sub-contractor, for gun boring and gun rifling lathes.

Production Change-Overs

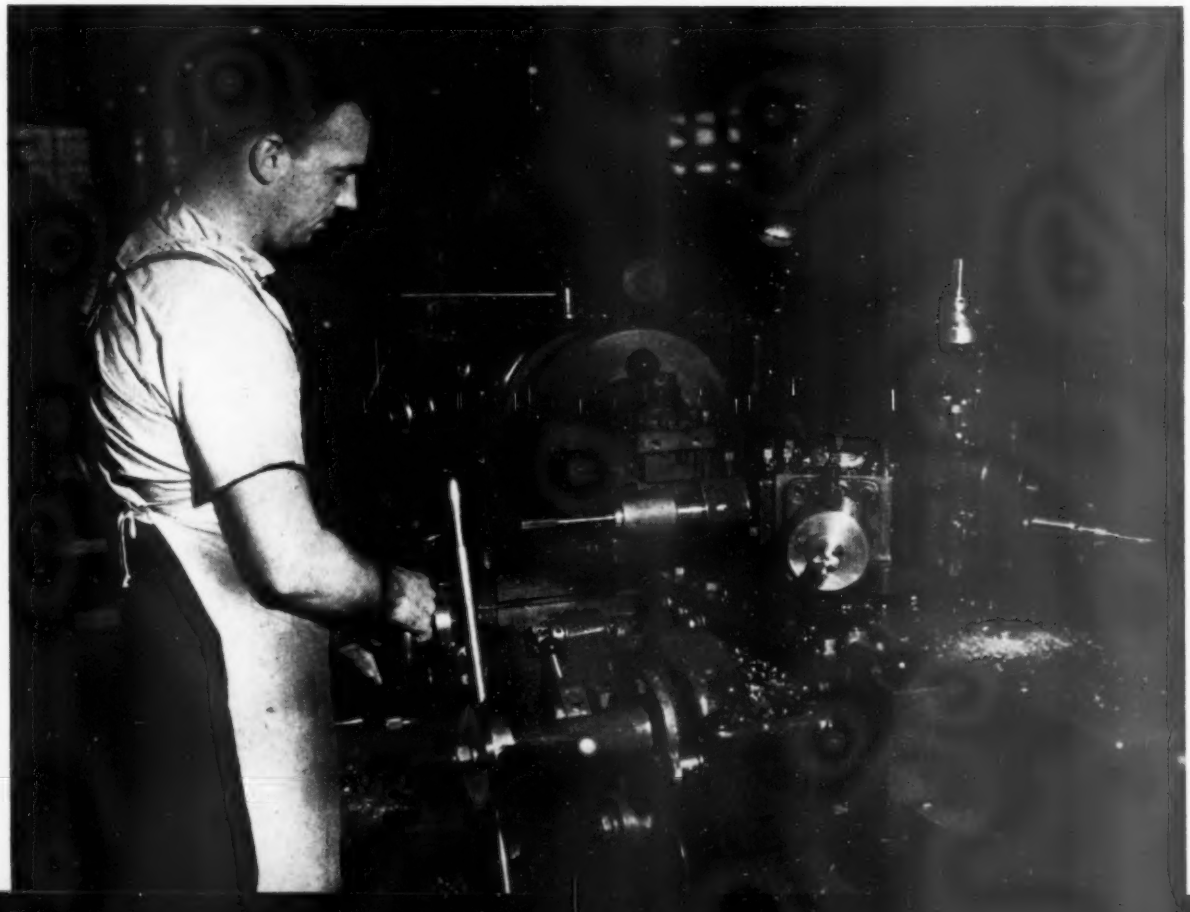
The survey shows that some astonishing change-overs from one type of production to another have been made. A Boston manufacturer of flutes and piccolos is boring gun barrels. Women skilled in the finest needlework have been reskilled to make fuses for shells and bombs. Producers of women's fine negligees are making mosquito-netting for use in semi-tropical army camps. A manufacturer of tobacco processing machinery is producing parts for Diesel engines.

And the list can be extended indefinitely. Of course, as the survey nears completion, the results will be analyzed, tabulated, and indexed for ready use in the further expansion of the defense program.

One of the serious problems constantly faced by the Defense Commission is the need for a wider distribution of the production to sub-contractors. Mr. Knudsen has continually emphasized this necessity. Certain products do not lend themselves readily to sub-division, but in many instances primary contractors are anxious to sub-let parts, and smaller plants are seeking such work. It is believed that the information developed in the present industrial census will assist materially in solving this problem.

The National Association and affiliated state groups have established channels through which contacts can be made and information disseminated. For several years N.A.M. has employed in Washington a production engineer, with an assisting staff, to facilitate negotiations between industry and the various military establishments. It has set up a National

Fulltime Production at Torpedo Station
A skilled worker operating a turret lathe at the Alexandria Torpedo Station.
National Defense Advisory Commission



Defense Committee, made up of industrialists from all over the country and many types of industry. The membership of the full committee has been broken down into sub-committees, which are concerned with such matters as priorities, prices, sub-contracting, and production. Many of these men are devoting practically all of their time to these specific jobs, without compensation or even reimbursement for expenses. Of course, you know that many manufacturing executives are serving as "dollar-a-year-men" devoting their large abilities unselfishly to the advancement of the defense program.

Whole industries have coordinated their facilities in the effort to step up production to the necessary pace. The outstanding example, with which you are familiar, is the Machine Tool industry. Its accomplishments have been almost unbelievable. Beginning in 1936 existing facilities were able to absorb the rising tide of foreign demand, until its approximate capacity was engaged when the war broke out in September, 1939. Since shipments of this period had been largely for export, it was realized that when the domestic load was added, capacity would not be adequate. "From this point," says Mr. Clifford S. Stillwell, Vice-President of the Warner and Swasey Company, "the addition of personnel and physical plant proceeded up to the point of France's downfall, since which period the rate of expansion has been accelerated at an unprecedented rate."

The speed with which output was stepped up can be measured by the increases in dollar volume. From a normal annual total of $100,000,000, the 1938 production reached $145,000,000. In 1940 it was $425,000,000 and it is estimated that shipments in 1941 will equal or exceed $650,000,000. The 1929 figure, highest in all previous experience, was $185,000,000.

Other industries have also made great forward strides. While none that I know of can match the Machine Tool record, the achievements of many have been notable and those of several have been spectacular.

Some communities have worked out comprehensive plans for coordinating all the defense activities within their local boundaries. One small city in Pennsylvania has instituted what it calls a "Program of interchanging operation". This is essentially a local application of the nation wide industrial census which is now under way. All relevant information was gathered together at one central point so that companies in the district with defense contracts could "farm out" various sections of that work to neighbors with facilities that were lacking in their own plants.

So successful was this plan in utilizing the town's full capacity and in speeding up the output of equipment and materials, that other cities have followed its cue and are inaugurating similar methods. Extended generally, it will prove a vital aid in meeting the demand for "speed and more speed". In some instances equipment that had been idle or only partially engaged has been moved from one plant to another. But oftener it has been found more practical to transfer the work.

Public Information Service

An overall estimate of progress on the entire production for defense was obtained a short time ago from a survey of 100 typical industrial areas undertaken by the Defense Committee of the N.A.M. The results showed that production had started on 95 per cent of all national defense orders which had been placed up to that time. The management of only 7 per cent of those plants so engaged think they cannot make deliveries on schedule, while 25 percent will complete their contracts ahead of the specified delivery dates. Some 10,000 manufacturing units are now engaged in producing vital defense necessities.

Another contribution of the National Association is the maintenance of a public information service, which employs all the customary agencies of news dissemination to keep the American people advised of the current progress on the preparedness program. Most noteworthy feature, perhaps, is the recently inaugurated series of weekly broadcasts over the facilities of the National Broadcasting Company. Probably no other radio program, except the addresses of the President, has had as wide a coverage as has been arranged for this series. The presentations are unique in that they originate in the work rooms of plants engaged in producing defense equipment and materials. The participants are largely supervisors and employees, who explain the nature and progress of the work they are doing. Listeners, who can hear the hum of machinery and other evidences of intense activity, thus obtain realistic proof that American industry is busy at the job of preparing for their defense.

One of the major difficulties of the present situation is the problem of man power. Some conception of its magnitude can be obtained from the National Industrial Conference Board's estimate that 18 billion man hours are required to complete the materials on defense contracts authorized through last December. This is the same number of man hours expended in 1939 on all manufacturing, mining, and steam railroading pursuits combined. Since the end of 1940, of course, additional awards have been made, and no account was taken in this estimate of the huge increases which will result from the 7 billion dollar appropriation recently requested for the British aid program.

Of course, the completion of this vast enterprise will not be attempted in any twelve month period, but whatever the time involved, it is a staggering undertaking. In the last world war it required two men in production at home to support one man at the front. Information coming out of Germany indicates that she has eighteen producers for every man in active military service. We are not yet far enough along to determine the necessary ratio in this country, but it will not be less than four to one.

The N.A.M. Defense Committee's survey showed that industries work-

ing on defense orders have a 45 per cent shortage of skilled labor, a 20 per cent shortage of semi-skilled labor, and a plentiful supply of unskilled labor. If these plants were to go under forced draft, working 24 hours a day, 7 days a week, a situation which may very easily develop, there would be a 73 per cent shortage of skilled labor, a 54 per cent shortage of semi-skilled labor, and the labor pool in these plant areas would be exhausted, with an actual shortage of unskilled labor.

This situation has been felt very keenly by those industries where the percentage of operations requiring skill is high. Among these, of course, is the Machine Tool industry. Up to December it had doubled its personnel in about twelve months. This means that it added about 40,000 workers to its payrolls, an almost incredible performance in an industry which normally relies very largely upon skilled and experienced men.

This result was accomplished by the introduction of a short-term program of learner training, as distinguished from full, long-term apprenticeship courses, which latter, while desirable in normal situations, would have been of little benefit in the present emergency. The results were amazing and the turn-over surprisingly low. Naturally, the majority of these new recruits were younger men, but the plan was applied with surprising success to men in the late forties and the early fifties.

Many other plants have adopted quick training procedures. Most of these provide for the development of competent foremen and supervisors, as well as production employees. The problem of supplying adequate supervision is even more acute at certain points than that of training workers. The Sperry Gyroscope Company is one of those with a well developed training program. Mr. R. E. Gillmor, its president, is a member of the N.A.M.'s Defense Committee and he, with some others working with him, has undertaken as his particular duty the dissemination of information on quick training methods to plants needing such assistance.

From this recital of plans and accomplishments, it must not be assumed that all the handicaps and obstacles have been overcome. It is inherent in the nature of such a vast undertaking that there should be much confusion and error. Industry itself has had to revise its own procedures as it has gained experience. But many of its difficulties have been imposed upon it and are not within its power to correct. It is to some of these obstacles that I want to devote a few minutes in this discussion. I do not approach them in a spirit of carping criticism, but in the hope that as their effect is more clearly understood, steps will be taken to remove them.

Generally the full scope of the defense effort has not been defined. In the earlier stages, the implied intent was to concern ourselves only with the protection of this country and certain other areas of the western hemisphere. Even then there was no clear statement of the defense objectives. More recently we have apparently been committed to the defense or release of all peoples the world around who are now menaced, or are already subjugated by the dictators—a total program certainly of incomprehensible magnitude.

Whatever may be the personal opinions of individual industrialists, American industry as such has not and will not attempt to tell government what its foreign relations policies should be, nor to dictate the development of its military technique. But industry has the right to expect from government a clearly drawn specification of the job it is expected to do, if we are to obtain our objective of production, more production, and still more production.

Producing Gas Masks
A gas mask is assembled at the Goodyear Tire & Rubber Company plant.
National Defense Advisory Commission

Planning Has Been Handicapped

Specifically there has been no tabulation of requirements of certain equipment and materials, either in total or by type. Planning has been greatly handicapped because producers have not known what and how much to make. Much of the procedure has necessarily been based upon guesswork rather than upon factual analysis. This haphazard method has resulted in an oversupply of some items and a serious scarcity of others.

Industry is also deeply concerned over the lack of general coordination and the absence of definitely delegated authority. To date the responsibility of the production member of the Defense Commission has been far less than the public has been led to believe and certain expected further changes in organization will probably increase the confusion as to his status.

Probably you are aware that there is afoot today a move to oust all "dollar-a-year men" from the defense service. This plan is mainly sponsored by the left wing element in Washington, which is primarily interested in the promotion of its so-called "reform" program. Unfortunately the plan has received the support of some conservative members of Congress, who have been misled by skillfully directed propaganda into believing

that these men have accepted their assignments in order to secure fat defense contracts for their own companies. If this effort succeeds, and the direction of the whole defense activity falls into the hands of politically minded men, with little or no experience in the problems and technique of production, the successful and speedy conclusion of the present enterprise will be seriously handicapped.

Another obstacle has been the operation and administration of several national laws affecting the hours and pay of labor. Principal among these, of course, are the Walsh-Healey Public Contracts Act, the Wage and Hour Law, and the National Labor Relations Act. While industry has questioned the soundness of many provisions in these measures, even as applied to normal operations, it recognizes them as the Law of the Land and has no intention of trying to evade them. But it is difficult to reconcile the current interpretation and administration of these acts, with an "all out" policy of national defense.

Many specific examples could be cited, but I have time to mention only a few of the ways in which these restrictions affect the defense effort. Under the Walsh-Healey Act, the Secretary of Labor has the power to establish certain wage minima on government contracts. Most plants are still largely engaged on commercial production and though they have facilities that they want to make available for defense work, they are fearful that their competitive positions on normal output will be jeopardized or destroyed by the necessity of raising all wages to the level established on government orders.

Certain sectional wage differentials have been set up and these also have operated to impede defense production. Under competitive bidding for defense jobs some producers are automatically eliminated, with the result that much desirable productive capacity is inactive, while plants in other sections are overloaded. Industry does not criticize the competitive basis of awarding contracts. In fact this traditional American method of getting business should be maintained, except under special conditions where some other procedure can wisely be adopted. But when arbitrary variations in cost are created by these labor laws, or department regulations under them, some adjustments, possibly in prices, should be made to permit the complete utilization of all suitable plant facilities.

You are familiar with the recent efforts to deny defense contracts to manufacturers who have been charged with violations of the National Labor Relations Act. Again I say that industry asks no immunity from the enforcement of existing laws, even though they may regard many of their provisions as unwise. But the practice of imposing arbitrary penalties before charges have been sustained by the courts is wholly indefensible and leads to the inference that the proponents of such action are more interested in punitive measures than they are in promoting the national defense. Actually these attempts adversely affect the public interest far more than they do the plants against which they are directed.

Limitation of Hours

Consideration of limitations on the length of the work week opens up a subject that is far too broad to cover in the time at my disposal. I want merely to point out two important angles from which it must be examined. The first, of course, is the effect on defense production. We cannot afford to stop short of any reasonable extension of hours consistent with the health and general well-being of the workers. A single example will serve to emphasize this point. It has been estimated that an increase of 5 per cent in the productivity of machine tools at present in use would provide immediately the equivalent capacity of all machine tools produced in this country in 1939. Five per cent of forty hours is two hours.

The second is the inevitable influence of current practice on the severity of the adjustment which must be made after the emergency ends. The most effective means of providing a cushion for this later inevitable shock will be the maintenance of as high a level of normal goods production as can be justified without curtailing the defense program. Some administration advisors insist that just the opposite course should be followed, and that all production of peacetime commodities should be eliminated, except such items as are necessary for subsistence. That policy would violate all the principles of economics, as well as the dictates of simple common sense.

It is very necessary, therefore, that there be no undue limitations on the hours of work. Of course, many plants engaged on defense orders are working overtime and paying time and a half for hours in excess of forty per week. Full utilization of plant facilities has not been secured by this expedient, but aside from this fact, costs are unreasonably increased, and the creation of wide disparities between the earning of one relatively small group and those of other gainfully employed persons, throws the economic processes out of balance and constitutes one of the causes of depressions. This whole subject is of importance far greater than is being attached to it and deserves the widest and deepest public interest.

Industry is reconciled to the payment of huge taxes and the drastic limitation of profits during future years. But the present unscientific and ever changing methods of determining tax liability should be replaced by a sound system, which will not penalize production and which will permit future plans to be worked out with some assurance of a stable taxing policy.

Governmental red tape and adherence to precedent is another deterrent to defense progress. Many of the delays are so absurd as to be laughable, but in the aggregate they constitute a serious and wholly unnecessary obstacle in the way of productive speed.

There are other sources of interruption, but the last one I want to men-

tion here is strikes. Recent statements which have indicated that only a small percentage of defense contracts has been affected by strikes are now admitted to have been inaccurate both as to the extent of the stoppages and the importance of the work involved. Chairman Vinson of the House Naval Committee recently surprised many with figures he presented to the House Judiciary Committee, translating labor disputes into defense production. He said a survey of time lost by labor disputes in only 127 industries was enough to build 325 bombers.

Industry questions the wisdom of legislation outlawing strikes, just as it disapproves all governmental control of the economic processes beyond the limits of necessary regulation. It favors the enforcement of a "cooling off" period before strikes are called. If a mediation board is set up, it must be so constituted that all parties to disagreements may be assured of fair and impartial consideration. In the last analysis dependence must be placed upon the force of public sentiment to correct this unfortunate and unwarranted trend, and in order that the pressure of its opinion may be brought to bear on the situation, the public must be given all the pertinent facts.

Labor leaders must consider the rapidly growing public disapproval of interruptions caused by jurisdictional disputes, insistence upon the open and "preferential" shops, and demands for unreasonable wage advances. The families of the men drafted into the military service are not going to view with favor the wide difference between the small pay of the draftees and the large earnings of other men who are established safely far behind the line of active duty. The practice of assessing men exorbitant fees for the privilege of helping to prepare their country to defend itself is wholly repugnant to fundamental Americanism, and will not long be tolerated by a public that is rapidly being aroused to the extent of these abuses.

Last year Industry was charged with deliberately delaying the start of defense production in order to enforce certain provisions with reference to plant amortization. There was not a shred of truth in this charge. Some day the dramatic story of industry in these times will be written and it will tell how many manufacturers risked millions of their stockholders' dollars to produce defense goods, with nothing more tangible than "letters of intention". It will have chapters on how industry, at its own expense, trained workers to fill better jobs and on how many industrialists operated plants to supply national needs on a pure cost basis without profit. Every selfish individual, regardless of position or function, who seeks to profiteer at the nation's expense should be sternly rebuked and properly restrained. The National Association of Manufacturers vigorously condemns any taking of unreasonable advantage in this emergency, call it profiteering or what you will. But industry's opposition to profiteering will be of no avail unless every other group, labor included, takes the same attitude. Unwarranted wage increases can be as truly classed as profiteering as excessive corporation margins.

President's Message

Recently in a national broadcast, the President stressed the theme of universal sacrifice. Many of us, I suspect, have been hoping against hope that the burden would not fall very heavily upon us individually. None of us can escape it. And our willingness to sacrifice will be measured by the valuation we place upon the heritage of liberty that has come down to us from our forefathers.

It is this heritage that we are preparing to defend. Its defense is not alone a matter of physical armaments. Total preparedness for America necessitates a national economy that is strong, confident, and well-balanced. We must be constantly alert to defend the noble structure which we have taken so long to erect, both from external foes and from insidious forces which seek to undermine it from within. What will it profit us if we gain the ultimate victory over the foreign aggressor and in the effort lose the precious heritage which we have fought to preserve?

In spite of tremendous handicaps and seemingly insurmountable obstacles, American industry is carrying on. It will measure up to the confidence which America has reposed in it. I cannot conclude without paying tribute to the loyalty, unselfish devotion, and patriotism of the vast majority of American workmen. Some minorities have been misled into unfortunate excesses, but the great body is clear thinking and dependable. There is no justification whatever for the apparent belief in some quarters that the interests of Management and Labor are inherently antagonistic. The greatest progress has been made and will continue to be made where there is mutual confidence and full cooperation.

These are troubled times. In every direction the horizon is clouded with doubt and uncertainty. It is easy to grow pessimistic and we cast our eyes questioningly toward the future. But we are still the masters of our destiny. With courage and determination we can attain the goal which has stood before us for more than a century and a half. In closing I want to leave with you the fine statement sent out last December as a Christmas greeting by Dr. Virgil Jordan, President of the National Industrial Conference Board, outstanding industrial economist, clear thinker, and courageous patriot. Here are his words:

"Through suffering and despair men will rediscover the ancient truth that work is prayer, the ultimate power to which they must appeal for their freedom, safety, and welfare. In the silent labor of the humble and obscure, done day by day in patient indifference to the pretensions of the State, the ambitions of its power seekers, and the burden of its parasites, every community will finally find strength to resist the pestilence of political exploitation which is the curse of mankind. Indispensable dynasties, dictators and presidents end in dust; all personal power perishes. The triumphal march of martial legions terminates in oblivion; and the most dazzling victories of arms, dissolve in the sweat and tears of the nameless millions who suffer them. The State is ever static and sterile; only the spirit, enterprise and integrity of men endure. As roots and tendrils penetrate the crannies and split the rock, the Supreme State, always the sepulcher of civilization, ultimately crumbles under the invisible energies of individual creative effort, and truth, honor, and freedom, crucified by force, rise again."

The FBI and National Defense

by L. R. PENNINGTON

Administrative Asst. to J. Edgar Hoover
Federal Bureau of Investigation

Now that America is committed to Aid to Britain, Saboteurs and spies will be more active than ever in their efforts to cripple our production.

LAW enforcement today has been challenged, not only by our five million criminals who are responsible for a crime every twenty-one seconds, but by groups of allegedly law abiding citizens, more vicious in their aims than the worst criminals in Alcatraz, who seek to undermine the very foundation of this nation. These subversive groups, many foreign born, many American born, many naturalized, are doing their best to fight against the success of our National Defense program. Our nation today, stands at a cross road in its history. In reality, a more serious cross road than most people realize. If we would avoid the fate of democratic peoples all over the world, peoples now ground beneath the heel of totalitarianism, it means that every one of us has mandatorily got to put his shoulder to the wheel in order that our program may go forward.

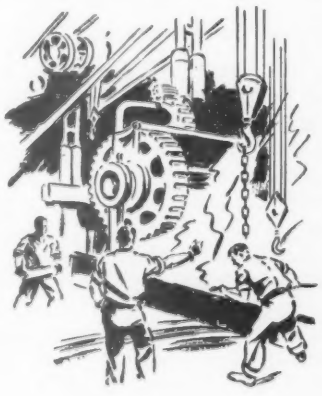
Tool Engineers have an important part to play in this program. If their program doesn't go through, it means that we will have one of the most serious bottlenecks in the history of American production. Today we face an entirely different type of war than we ever had in the world before. Heretofore, it was simply a case of army against army, but today, looking back over what has happened in European countries over the past fifteen months, we find that there has been a gradual infiltration into those countries, over a period of years, of those who would kill off democracy. We know from what they have done that in many instances they pledged their allegiance to other nations. We know they bit the hand which has fed them and with what we know as to what has happened in Europe, it is obvious we are in a position to state that same thing cannot and will not happen here in the United States.

The dictators openly boast that artillery will be supplanted by propaganda. They intend to break down the enemy psychologically before the armies even begin to operate. The nation, to be overrun, must be demoralized and ready to capitulate before military action can even be thought of. Mental confusion, indecisiveness, panic—these are the weapons of the dictators. In totalitarian countries, you have a blind loyalty to Fascism, Communism, or Naziism, which has been developed through the preachings of those doctrines to youngsters hardly out of the cradle. It is continued into the high schools, into their colleges and now that same group of individuals is trying to preach those same un-American doctrines to the youth of this country.

Fore-warned is fore-armed, and aroused Americanism has already started the propaganda of driving those totalitarian propagandists out of this country. You have but to pick up newspapers of various types, Sectarian papers, Labor papers, and you can see exactly what is happening. The dictator nations are doing everything in their power to pit race against race, and creed against creed and knowing this, we know the source of that propaganda and we are now in a position to circumvent it.

Dealing with Sabotage

In September of 1939, the President called upon the F.B.I. to take charge of work in our nation and in our internal defense dealings with espionage, sabotage and subversive activities. In a directive to the F.B.I., he called upon us to seek the cooperation of police agencies throughout the United States, and in furtherance of that program, there have been, over the past several months, 500 regional conferences held. Attending those conventions were 8,000 police officials, representing a total police personnel of approximately 200,000 officers. At those conferences it was decided that matters purely local in nature would be handled by local agencies. Those having interstate or national ramifications were to be handled by the F.B.I. When the police official goes out and makes an investigation, he submits



his report to the local divisional office of the F.B.I., of which we have 53 throughout the United States, including one in Hawaii, one in Alaska, and one in Puerto Rico. When such a report is received, it is sent to headquarters at Washington and while, in some instances, the matter under investigation initially gives the appearance of being local, we frequently find that it may be a link in the chain we are trying to form against a subversive group. In addition to our cooperative work with police agencies throughout the United States, weekly conferences are held in Washington. Mr. Hoover is Chairman of this group. Attending the meetings are the Commanding General of Military Intelligence, the Commanding Admiral of the Navy Intelligence, an Assistant Secretary of State and Assistant Secretary of the Treasury. There, matters of mutual interest are very fully discussed and one of the matters of discussion which came up at those conferences, that which I intend to speak to you principally on this evening, is the matter of Plant Protection and obviating sabotage in plants throughout the United States.

We found some very interesting developments, or lack of attention to plants in making those surveys. In one plant which an agent entered, he found that the guards were superannuated employees, too old to longer do any gainful work and the plant officials, with an eye to economy, had placed those men on the gates. Their average age was in the neighborhood of 70. You can readily see that men of that age obviously cannot do the work necessary on the entrances to a plant having a National Defense contract.

Efficient Guards Needed

I heard about one interesting incident up at Niagara Falls some time ago. A vice president of a large company in which the F.B.I. had conducted an investigation, made an interesting comment on the F.B.I.'s survey of his particular plant. He stated that after the system of requiring definite identification before anyone entered the premises, was established, the wife of the President came down to see her husband. The guard had rather strict instructions that no one was to enter without the identification badge. Well, the President's wife did not get in. She went home. Apparently her pocketbook must have been empty when she came down prior to going shopping. She was very much incensed. When her husband returned, she demanded the instantaneous discharge of that watchman. The husband not only refused, but promoted the watchman. Now what bothers the junior executives of that plant is whether the watchman was promoted for keeping out the President's wife or for carrying out orders. They don't know yet.

Inspector Pennington
"It behooves us to make sacrifices."

In maintaining or hiring guards for your entrances, that is a key point, you have to have men with intelligence and men whom you know are loyal, men in whom there is no question as to citizenship. And thus, it is really imperative that you make some investigation of that employee's background. Now in all its work in plant surveys, the F.B.I. does not in any instance enter into employer-employee relationships. That is a problem strictly for you, but no would-be employee, who is a strictly honest 100% American citizen can resent the fact that you want to know his background before you hire him, because those employees who are 100% Americans, realize the fact that a saboteur in their plant can cause the destruction of that plant, may cause many of them to lose their lives. So I think you will have no difficulty on that score when the purpose for which the investigation is made is definitely known.

Too many plants are allowing visitors to enter. We have recently had a number of instances where visitors from totalitarian countries have come to the United States, unobtrusively acting in the capacity of real and honest - to - goodness visitors. They have taken some interesting photographs. Some of them have lost some of those photographs and they don't know where they have lost them. They are interested in coming around to plants having National Defense contracts. They want to know the production; they want to know what is being made, how fast particular items are being turned out. It would be well for that information to be kept in the hands of as few as possible and to warn employees that it is not to their interest to furnish information concerning the inside workings of the plant to strangers.

Instances Cited

In one case investigated recently in a middle west factory engaged in the construction of reduction gears for American Naval vessels, there was discovered a considerable quantity of shavings in reduction units in such amounts as to cause serious damage. We have had a number of instances where there have been attempts at sabotage of airplanes. On one occasion, while a motor was being tested, metal chips were introduced into the lubricating system, doing considerable damage. In another instance, rags placed in the lubricating system in such a manner as to impede the lubrication of the motor caused damage. Recently when a large bomber plane, built for the Army was undergoing a test and the approval flights, the wiring of various toggle switches on the instrument panel was deliberately manipulated in such a way that the landing gear of this gigantic plane was made completely inoperative. However, in this instance, the saboteur, evidently crowded for time in his operation, manipulated the wires on the wrong toggle switch and as a result he gummed the whole works up and it was discovered before anything could happen. In another instance we found bolts sawed through which were

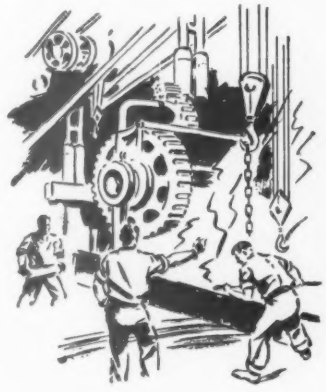
going on planes. Initially it was thought to be in the plant where the plane was assembled but ultimately the agent traced it back to the point where the bolts were actually made. The defects had been covered with a coating of rust resisting paint. That was corrected before any considerable damage was done. In a recent investigation, we found that 6 yards of muslin were removed from the gasoline tanks of one plane. Packages of safety matches were pressed into the greasing case and core points of wing struts and balls of electric tape were removed from gasoline pumps of aircraft. In all those cases we are trying to advise officials just what they can do, as to how limitations can be placed on the activity of individuals so it can be narrowed down to where a certain piece of sabotage may have occurred.

Notwithstanding these cases, we have not had sabotage in this country to the extent that is generally believed. Just the minute you have a fire or an explosion in a large plant, the cry is immediately raised of sabotage. Now let me give you an example of the figures collected by the insurance companies of the United States for the years 1938 and 1939 and their comparison with the possibility of sabotage in 1940. In 1939 there were 23,700 fires in manufacturing institutions and in 1938 there were 3,000 more—26,700. In 1939 there were explosions averaging 29 a day in manufacturing plants throughout the United States, whereas, in 1938 they averaged about 22 explosions per day. Now let me compare that with 1940. We have talked to the insurance companies and their representatives and they state that, taking into consideration the enlargement of some plants and buildings of other new plants, there has not been an appreciable increase in explosions in plants having National Defense contracts. Now recently there was headlined, an explosion along the Atlantic seaboard in which a number of individuals were killed. It was immediately claimed that sabotage was responsible but let me give you the facts and you can judge for yourself as to whether a saboteur was responsible for that explosion. The company was engaged in the manufacture of smokeless powder. Heretofore when smokeless powder was manufactured, the largest amount of the green product in a vat totaled 1400 pounds. It was also made in wooden vats. In this new plant which had just started into operation and had not manufactured one single pound of the completed product, they were placing 18,000 pounds of the green mixture in each vat. In addition to that, the vats were metal. Now the engineers knew that some gases were generated. They used electric fans which revolved at the rate of 3500 r.p.m. and in four different manners they tried to draw off the gases. In this case, as I stated before, a single pound of powder was not completed when the plant blew up, destroyed a number of vats, as well as killed a number of employees. But you can see from those facts that there is quite a difference in the story as it initially came out.

Use of Counter-Espionage

The first principle employed by the F.B.I. in meeting foreign foes within our midst has been the medium of counter-espionage. It is far better to know who those enemies are, to know their contacts, their sources of information, their associates and methods of communication, than it is to arrest a number of the lesser fry and have to start all over again. That has been done today in many instances throughout the United States and foreign agents are rather afraid of this method of handling the situation and as a result there have been many personal repercussions against the F.B.I. From the vicious smear campaign launched last year, you must realize that the minute dictator henchmen are backed into the corner the cry is raised of 'Gestapo' or 'Ogpu'. It appeared to us last year that all the crooks, the crackpots, the Red rabble rousers and otherwise innocent persons who were in turn victims of falsehoods, chimed in and climbed on a bandwagon intent on maligning the F.B.I. They raised the charge of violation of civil liberty yet, the very individuals in this nation who are trying to tear down the constitution are the very ones who yell for the support of the constitution and cry out that their civil liberties are being violated, just the minute you try in any manner to curtail their un-American activities. They also made the charge that the F.B.I. had compelled investigation of individual groups and organizations engaged in subversive activities. The F. B. I. is guilty of those charges. We feel that we would have been derelict in our duty if we did not have records concerning organizations and individuals whose interests are inimical to ours. I personally feel, from the number of years I have been with Mr. Hoover that he has done more for civil liberties than any other individual engaged in law enforcement. It is no surprise to us that Mr. Hoover is the target of every Communist, Nazi, Fascist, power seeker and would-be Red. That criticism of the F.B.I. and Mr. Hoover is the answer to law abiding citizens that the F. B. I. is doing its duty on the job. Atilla and his Huns were but babes in the woods compared to those groups who have created a holocaust of Europe and will subject us to a similar fate if we do not prepare. Do not allow the propagandist, tainted with the stench of totalitarianism, to tell you that we should not prepare to defend ourselves. That is again, the same self-propaganda which was fed to many of the nations now crushed beneath the heel of Naziism.

In a world where seemingly might makes right, it behooves us as Americans to make any necessary sacrifices now to forestall even greater sacrifices later. We are fortunate to be citizens of one of the last bulwarks of democracy and shall so guard that democracy that in the words of our martyred president, Abraham Lincoln, 'The government of the people, by the people and for the people, shall not perish from the earth.'



PART II

AIRCRAFT REQUIREMENTS

THE airplane has made man's world three dimensional. At the same time that the world of the pilot and his passengers has heightened, the sphere of operations for the engineer has swelled to unprecedented proportions. While designing the airplane, the engineer has reached his greatest development through coping with the problems of that treacherous medium—the air.

The airplane has poised for the Tool Engineer, too, some of the toughest problems he has ever been called upon to solve. That sleek metal "skin" must be painstakingly fastened into place with two million rivets—two million tiny little bottlenecks, mocking the demands for speed and more speed.

The power plant is so far removed from automobile engines as to seem almost unrelated. Here are no comfortable safety factors, no engines that cruise most of the time at a fraction of their available power. The goal that is sought is a pound of weight per horse power. A decade ago such a goal would have seemed fantastic, tomorrow the present goal may be cut in half. In these engines a hairline scratch may cause dangerous fracture or failure. For the designers to plan such an engine is comparatively easy in contrast to the task of Tool Engineers in reproducing it in quantity within the exceedingly close specifications.

The airplane was designed and built for peace. Airplanes, men said, would bind the earth together in one great brotherhood. But it did not take other men long to visualize its possibilities for destruction.

Tool Engineers have found methods of producing fuselages, wings, empennage, and engines in small quantities. Their methods were sufficient for the needs of commercial airlines and the few individuals who could afford private planes. Now, production must be increased perhaps as much as five times over in five years.

To do this it is not enough to increase floor space and have five times as many people performing the same operations as before. Such an increase calls for refinement of method, for the application of mass production techniques to an industry where many claimed such manufacturing procedure was impossible.

Success will make us an arsenal for this war; but more, it will leave us with the knowledge, the equipment, and the personnel to create a traffic in the skyways of tomorrow commensurate with that upon the highways of today.

It is the mightiest challenge in the history of Tool Engineering.

(Illustration—"Riveting a YB-17 Body"—Courtesy U. S. Army Air Corps)

Fuselage Production

by LOUIS BIEHLER
Assistant Superintendent, Pullman-Standard Car Manufacturing Co.

Limited production and rapid changes in the design of planes makes the tooling process one that is not only difficult but continually changing.

MOST commercial airplanes consist of four major assemblies: Fuselage or Body Assembly, Wing Assembly and Empennage, or Tail Assembly, and Center Section. The center section is the section set into the fuselage between the wings. It extends outboard each side of the fuselage just beyond the engine mountings. The wing, which is slotted to prevent stalling, is equipped with aileron and flaps which add wing area and allow lower landing speed. Some flaps are of the hinged type while others are called the fowler type, which are retractable. The left wing and right wing are separate assemblies and are assembled to the center section by means of attaching pins through rugged fittings attached to the main beam and shear beams, and then attaching screws all around the wing skin into the reinforced center section skin. The tail assembly consists of horizontal stabilizer, elevator, and vertical stabilizer and rudder. It is attached to the fuselage by means of attaching angles, with rivets and screws. It may be interesting to note that there are over two million rivets in an airplane.

Design of the airplane determines to a large extent production methods. The improvement in design from models of 1935 to the present made it possible to increase the pay load by 66%, while the cruising speed increased 16% and labor cost decreased approximately 23%. These figures were based on ten ship orders to the shop. You can see what improvement would be shown in labor cost when shop orders of 50 to 100 or more ships are sent through the shop. Limited production necessarily calls for simple wood and metal jigs for fabrication and assembly.

Volume production changes the picture considerably, inasmuch as we build more expensive special tools and eliminate slow hand work. The fuselage, like the airplane, is broken down into major, sub-assemblies and detail assemblies. The detail assemblies are composed of the various fabricated parts.

National Defense Advisory Commission
Douglas Giant Bomber
Wing and fuselage mid-section prior to being removed from jig.

Fuselage Fixtures, Designs

The fuselage is a structure used to house the crew, passengers or cargo in the airplane. It performs a function similar to the body of an automobile.

Before entering into the subject of fuselage fixtures, designs, etc., it is necessary that a few of the influencing factors be brought to your attention. To obtain the best possible efficiency, the aircraft design must be such that wherever possible the maximum structural properties are obtained from material used. In line with the above, structures are so designed that they are composed mainly of castings, forgings, and non-rigid sheet metal parts. Covering skins are so designed that they carry a large part of the stress, therefore it is necessary that all attaching holes be held to tolerances from .0015 to .003. It is also evident that, due to the flexibility of sheet metal parts and the close tolerances

required of the finished product, all attaching or mating parts must be held rigidly in place until the assembly is complete or nearly complete. Along with the necessity of holding all major points during assembly, it is necessary to do a maximum amount of the work on the fuselage structure while in the jig. For example, there are a large number of skins attached to the structure with rivets that have a center distance of approximately 5/8 of an inch along the line of attachment, and it is absolutely necessary that the maximum amount of such attachments be made while the structure is still being held rigidly in place.

Louis Biehler (Right)
Nils Lou (Center), Chief Tool Engineer at Glenn L. Martin discusses fuselage problems with Mr. Biehler and Connie Hersam.

The foregoing demands that the structure being fabricated be accessible and free of any interference.

As stated before, the design of the jig is dependent upon the type of airplane designed. For example, one of the aircraft manufacturers makes an airplane with rings (or bulkheads) spliced on the horizontal center line of the ship. This design makes it possible to build a very simple jig, as the upper and lower halves of the fuselage may be built in one jig during the experimental stage, while for production separate jigs would be used. This type of construction also makes it possible to install a large number of subassemblies in each section before the two halves are joined together, which would save considerable time if assembled in this way instead of further down the assembly line. The aircraft manufacturer referred to uses three major fixtures to do the final assembling of the fuselage structure.

One jig for the lower section is composed of inverted channels supported by a tube or pipe base to which locators for individual bulkhead rings are attached. At either end of the jig are locators for the end bulkheads. Rings are plumbed and then held in position by fuselage structure stringers.

Included in this jig are locators to hold the stub wing to wing attaching brackets in place. The lower section is assembled upon this fixture in the inverted position. The fixture for the upper half is similar to the lower, except that no provision is made for the locating of the stub wing attachment. The jig for assembling or mating the upper and lower halves is composed of end stands which are attached to the end of the stub section and a stand for the tail end. The average time for assembling the upper and lower halves is approximately six hours.

Design Affects Tooling

Another manufacturer has an aircraft design which makes it necessary to assemble the complete structure at one time. This necessitates a more complex jig. All rings (or bulkheads) and other major points have to be held in the jig by locators, and at the same time must be so designed that they can be hinged away to assemble the skin panels. The manufacturer referred to uses two types of construction on these jigs. The original structures were of the welded type, using "H" beams and channels for uprights and angle for the rest of the jig. A latter type of fixture is of a universal type, designed so that approximately 90% of the material in the fixture could be salvaged. To enlarge on this particular design the jig uprights are of casing with a large floor plate welded to one end. These uprights are then grouted into the floor with sulphur. To this structure are attached special 90° castings with ball joint fittings. The tops of the ball joints are then set level or on an angle if so necessary. Then "H" beams that have a pad welded on one face and one on each end, machined square with each other and an angle bolted on each, are bolted to the top of the ball joint, thus making the main structure of the jig. With the top of the ball joint set level and the "H" beams having been machined and bolted to the joint, the machined surface is used as a base for setting all of the locators. All calculations for setting are taken from this machined surface. Attached to the upper end of the casings are cross members of the welded "H" beams, also attached by ball joint referred to. Another beam full length of the jig is mounted to the aforementioned "H" beam. The top ring (or bulkhead) locators and other fittings are attached. This beam also acts as a monorail for removing the fuselage structure from the jig. Additional support is given to the jig structure by bridge-like structural panels which serve the dual purpose of giving rigidity in the horizontal plane as well as support for the flooring of the upper scaffolding.

In order to obtain maximum production and accessibility, all permanent points of the jig are so designed as to be eighteen inches from the airplane structure. This allows for the use of standard drill motors, rivet guns and rivet squeezers. As stated before, all sections of the fuselage structure must be accessible. With eighteen inches of free space between fuselage structure and jig there is ample room for any type of tool or hand work to be done. The major locators where accuracy is required, such as the shear beams, windshield, cabin door, baggage doors, empennage attachment and tail wheel locators are so built that they are rugged and rigid, and at the same time can be either swung to one side or removed with ease. This latter type of construction shows a marked improvement over the welded, not only in reduction of the time required to make a fuselage fixture by approximately one hundred to three hundred hours, but also to speed up the manufacture of the finished product by approximately seventy-five hours, not to mention the salvage of

approximately 90% of the fuselage fixture which can be put back into the stock room and used for new models, or for wing, center section or empennage jigs.

There are 294 sub-assemblies which are assembled together in the fuselage jig. This requires 67 separate operations in proper sequence. *Fifty* men are required for the assembly of one fuselage per day. From the fuselage jig (Station No. 1) to preparation for flight test, there are fourteen stations. As the fuselage progresses through these stations, additional assemblies are installed until the ship is finally ready for flight test.

U. S. Army Air Corps

Boeing Bombers
Production line for fuselages with wing assembly in background.

A Different Technique

The tooling problem on large airplanes represents an entirely different picture due to the size, weight, and cost of the fixturing, unstable conditions of the terrain, and concrete flooring upon which the fixturing is mounted; and the thermal expansion and contraction differences between the metals used in the fuselage and those used in the fixtures.

The procedure followed by one manufacturer is to furnish complete tooling for the interchangeability points and to support the structure between these points by wood or steel scaffolding and staging. By following this procedure it is necessary to continuously use the transit, plumb-bob and wire to check the basic locations due to floor movements, thermal expansion and contraction differences, and changing load conditions.

Mechanical means must be provided to handle the finished sections in moving them from their assembly fixtures to their respective points of installation.

To insure interchangeability between the major parts, the final reaming or drilling of all holes making up the joints should be done at a constant temperature.

The base of the fixture for constructing the center section of the fuselage, is made of steel, which supports plates of a like material as that used in box beam of the center section.

This allows for thermal expansion and contraction in a direction parallel to the box beam. Upon this plate is built a steel structure which supports another plate, made of the same material as that used in the base, to which are attached blocks to determine the location of the main attaching fittings. This plate is so designed as to allow for thermal expansion and contraction differences in a vertical plane passed through the center line of the fuselage. Between these supporting structures, the box beam is supported by wooden cradles. Adjustment of these is made by use of wedges. The fuselage is assembled in both directions from this central point.

The nose wheel well is assembled on a steel structure. The main attaching points are held, around which the rest of the structure is built. Upon completion, the entire structure, including the fixture, is slid into place for installation. The construction of the center section, the windshield and nose section of the fuselage is assembled upon a steel supporting structure, the main coordinating points being held in alignment. Upon completion it is carried into position and attached.

The barrel sections of the fuselage are built up as separate assemblies in lengths which average ten feet. The bulkheads at the ends of these sections are held in place by wood locating fixtures. The windows, doors, flooring, partitions, plumbing, and as many other parts as possible, are assembled at this time. The parts located at the ends of these barrel sections are not permanently tied together, so that during their installation the sections may be located and then fastened to each other. Between the main bulkhead locators, the barrel sections are supported by means of wooden cradling supports. Adjustment of these is by use of wedges.

The center line of the fuselage must be held in alignment at all times during construction, and must be constantly checked.

This discussion is not the acme of tooling possibilities, but is merely offered as suggestive of what tool manufacturers have used in the way of tooling for air planes. It is hoped that the hints given here may offer some aid as to other tooling problems that may be encountered.

Aircraft Engine Design

by C. W. VAN RANST

Chief Aircraft Engineer
Ford Motor Company

An analysis of some unusual departures from precedent in the design of a new 12 cylinder in line aircraft engine.

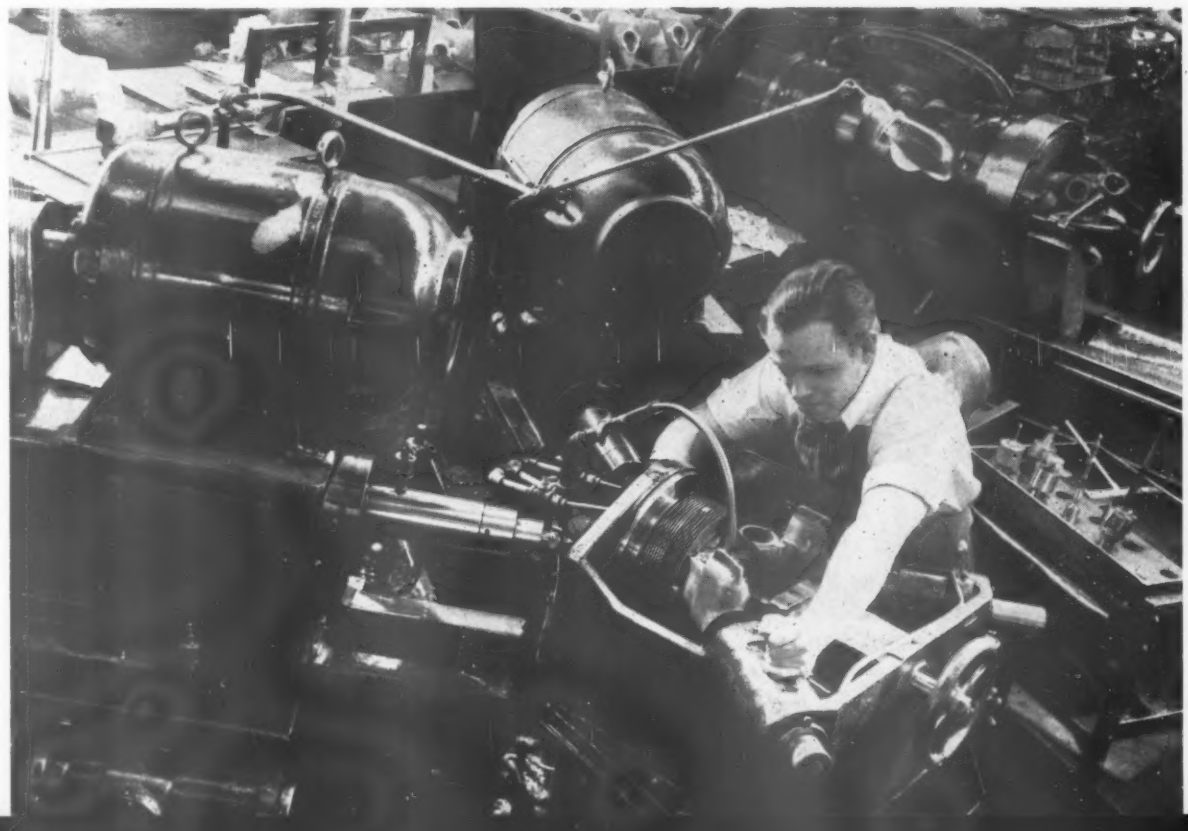
Editor's Note: For an analysis of the production of Aircraft Engines see The Tool Engineer, January, 1941, p. 42.

MUCH deserved praise has been directed toward the tool industry in recent months for the magnificent job done in meeting—to an unexpected degree—the requirements of the defense program. The quality and variety of high precision machine tools now available gives to every designer a degree of latitude unknown even in the comparatively recent past. As a consequence, valuable ideas which only a short while back had to be abandoned because they were—in a manufacturing sense—too slow, too difficult, too costly, or even impossible, are now commercially feasible. Let me here say that while the availability of completely modern machine tools may not affect the actual ability of a designer, such a circumstance certainly will go a long way toward enhancing his reputation.

In discussing aircraft engines, as there are probably more different opinions than there are engines, I am going to avoid discussing the relative merits of the different types. You are all probably aware that the Ford Motor Company has contracted to build Pratt and Whitney air cooled engines and a new and completely modern manufacturing plant is very near completion.

The latter part of last June it was decided that we should design an aircraft engine of our own—and that the entire program be carried out at our own expense—so that we might be entirely free to pursue our own inclinations. After considerable planning, it was decided to launch an experimental program covering an *in-line* liquid cooled V-12 upright engine. For the present I am sure it will be more constructive and of greater in-

Pratt & Whitney Twin Wasp Cylinder Head
The valve seat and valve bosses are being drilled and bored. *U. S. Army Air Corps*



terest to tell you just what we are trying to do in this engine program of ours.

Realizing there must be some end to the continual increase of displacement to obtain greater horsepower, although that is probably the easiest and quickest way to obtain such results, we felt that we would be making far greater advancement if we could get greater horsepower out of a given displacement. Anyone well versed in this line of work will probably assume that we are bidding for a nice bunch of headaches and his assumptions may be well founded. But we felt that sooner or later someone would have to do this job and we might just as well start now.

Two Cylinder Test

The Liberty engine—with a displacement of 1650 cubic inches—delivered in the neighborhood of 450 horsepower at approximately 1700 revolutions per minute and in a little over fifteen years an engine with exactly the same displacement was delivering over a thousand horsepower—but at very much higher revolutions per minute.

We reasoned, and I believe logically, that with the improvement in fuel and materials and what continued experience had taught us—that this performance could be carried still further so we elected to take the same displacement and set our goal between 1800 and 2000 horsepower at 3600 revolutions per minute.

We decided very definitely on three items:

First, that the engine would have to be highly supercharged;

Second, that the supercharger should be driven by an exhaust turbine with no mechanical connection whatsoever between engine and supercharger and

Third, that we would use solid injection of fuel directly into the combustion chamber.

Layouts were started about the middle of July on the twelve cylinder engine and within three months' time a two cylinder engine was completed and on the stand ready for testing. This engine, in effect, is the same as slicing two cylinders off the end of the twelve cylinder engine and includes the identical camshaft and accessory drives. There is a distinct advantage to this method of testing as it gives a fairly accurate check on connecting rod bearings and cylinder lubrication and is smoother running than a single cylinder engine. In the process of designing this engine, we have paid particular attention to accessibility and to keep as far away as possible from costly machining operations.

U. S. Army Air Corps

Pratt & Whitney Assembly

Two-row engine power sections are assembled separately.

In most cases where exhaust driven superchargers have been used, they are separate units and it has been up to the airplane designer to find a place for them some where in the airplane.

This also is true of the intercooler that becomes necessary when high supercharger pressures are used. In cases where it has been impossible for the airplane designer to properly install these supercharger units, adverse aerodynamic conditions have resulted that brought about a loss rather than a gain.

In our design, we have endeavored to furnish the airplane manufacturer with a complete power plant. We have made the exhaust turbine and supercharger an integral part of the engine and have also included the intercooler. In so doing we have achieved a perfect *aero-dynamic condition* owing to the fact that the air intake to the supercharger and the exhaust from the turbine are in the direction of flight so there is no drag from the intake and a distinct propulsion effect from the exhaust.

The exhaust driven supercharger is probably one of the greatest contributions to the high output engine. To obtain higher output and to maintain it to high altitudes requires higher manifold pressures and this in turn practically dictates a two stage compressor. Any endeavor to fulfill these requirements by means of a mechanically driven unit results in an unwarranted absorption of power.

A good example of this is to say that a mechanically supercharged engine delivering 1800 horsepower would deliver approximately 2050 horsepower if supercharged by an exhaust turbine. This, you will readily see, is very nearly a 15 per cent gain or 250 horsepower. With the use of solid fuel injection directly into the combustion chamber—air alone is delivered from the supercharger — and by increasing the normal overlap of the exhaust and inlet valves, it is possible to use this compressed air as a means toward better scavenging and better cooling of the exhaust valves and the head of the piston.

This all takes place, of course, at the top of the stroke and just before the injection of fuel, so all that is lost is a small quantity of air.

The location of the injector nozzle

and the spark plugs we have found to be very important, and to take full advantage of this type of induction the engine must be specially designed for it.

We think of this power plant as a combination high and low pressure unit. The reciprocating unit we consider the high pressure side and the supercharger unit the low pressure side.

We believe, and our tests are bearing us out, that it is possible by means of supercharging to obtain a 100 per

Van Ranst (left)
Talks it over with Walter Wagner.

cent — or more — increase in horsepower over and above an atmospheric engine.

As an example, experience indicates that a 950 horsepower atmospheric engine may be brought to deliver 1900 horsepower at sea level by the addition of approximately 75 pounds of weight for the supercharger and about another 100 pounds to the engine structure to enable it to satisfactorily withstand the higher pressures.

It is immediately obvious that we have accomplished a 950 horsepower gain for an increase of about 175 pounds of weight or at the rate of approximately one-fifth of a pound per horsepower. This of course is a great deal lighter than it is possible to build a non-supercharged reciprocating type engine having the same volumetric displacement.

We believe that engines of this compound type will be built to function at less than one pound per horsepower.

Owing to the fact that the centrifugal compressor and the exhaust turbine are such intimate parts of our power plant and that upon their success depends the success of the complete unit, we have set up a research department and are designing our own compressors and turbines.

We are doing this with a view toward not only increasing the efficiency but toward developing a construction that can be produced commercially. We have deviated to quite an extent from the conventional type of supercharger and turbine with the hope of obtaining higher efficiencies than have heretofore been considered possible.

Our early work with the two cylinder test engine has been very encouraging and although it has been running only a few months, we have already pulled the horsepower that we set as our goal. The engine withstands speeds up to 3600 revolutions per minute in very good fashion and will probably have a cruising speed between 3000 and 3200 revolutions per minute.

We believe that failure of current engines to operate at higher revolutions per minute is due at least in part to lack of rigidity of the structure. We have paid particular attention to this phase and have attempted to design our engine with considerably more of what we may term "backbone."

Rigid Crankshaft

To accomplish this we have designed a cast counterbalanced crankshaft with a liberal overlap of the crankpin and main bearing. Also, the cheeks contain enough material to provide the required stiffness.

In our opinion it would be difficult to over-emphasize the basic importance of a sufficiently rigid crankshaft.

To further the rigidity of the structure, we have made the cylinders and the crankcase an integral aluminum casting with water jackets the full length of the cylinder barrel. We have adopted the dry type of cylinder liner made from centrifugally cast oil hardened steel. This type of cylinder contributes a great deal to the stiffness of the structure and we believe more than offsets the small difference in thermal efficiency as compared to the wet type liner.

We have kept the cylinder walls free from flanges or bosses throughout their length to avoid distortion due to temperature. This is of the utmost importance in promoting favorable conditions for the proper functioning of piston rings. Any surface irregularities, however minute, induce ring flutter which in turn aggravates blow-by.

With the use of high pressures in combination with high temperatures, excessive blow-by breaks down piston and ring lubrication. Also, it causes a rise in piston temperatures with a result that is apt to be disastrous. It is such refinement of numerous details that makes it possible to increase the allowable output of an engine.

We feel, that too great liberties have been taken in reducing the length of pistons, in some cases the length being only one-half the diameter.

We have designed our piston very nearly square, that is, the length is almost equal to the diameter. The increased stabilization resulting from a better length diameter ratio also has a profound effect on piston ring performance and in addition influences heat dissipation favorably.

The use of side by side connecting rods and floating connecting rod bearings is another departure from the conventional aircraft practice and is identical with the connecting rods used with the Ford V-8 engine. In this arrangement both rods are the same which greatly facilitates balancing and effects a saving in weight.

Within the limits necessarily imposed, I have endeavored to cover briefly the more important—or perhaps more accurately—the less conventional points of design. It has also been my purpose to convey some idea of the lines along which our thinking has proceeded—some idea as to the manner in which we have approached the problem.

PART III

ORDNANCE REQUIREMENTS

SOME months ago, a high naval official testifying in Washington, made a reference to the Flatiron Building. Hearers were worried not so much by their disagreement with his statement as by the fact that the use of the Flatiron Building as a symbol for modern progress went out of fashion about the time people stopped yelling "get a horse" at passing cars.

That a sort of horse and buggy thinking has impeded the progress of our Army and Navy is a fear held by many thoughtful citizens today. That there has been a great deal of planning and preparation for such a wartime production as we now face, the severest critics cannot deny, and if the planning has at times been shortsighted in connection with the newer implements of war that policy has recently undergone a considerable change.

So efficient and farsighted has been the planning that there has apparently been little of the wasteful buying and inefficiency that characterized much of the preparation for the last war.

It has thus been possible for Tool Engineers to attack without unreasonable delay the problems of production of the many items of ordnance needed. Most spectacular are the heavy 16-inch guns used on battleships and in the coast artillery.

But ordnance is more than big guns; it is more than all guns of all calibre. It is made up of thousands of items needed by armed forces for fighting and maintenance. Many of these items are commonplace; their production may only involve slight changes of specifications, others involve entire new tooling set-ups or the alteration of machinery to make cartridge cases of lip stick tubes, detonators instead of typewriters, gas masks instead of vacuum cleaners.

There are limitations placed on the Tool Engineer. Limitations caused by shortages of certain raw materials; limitations caused by delays in the delivery of machine tools; limitations resulting from changes in specifications and delays caused by administrative red tape. But America is unaccustomed to thinking in terms of limitations. Conditioned by experience to virtual miracles of production, they will brook no delays now.

Once again Tool Engineers must combine the ideas of the designing engineer and the power of the mechanical engineer and from the genius of a few evolve production for the many.

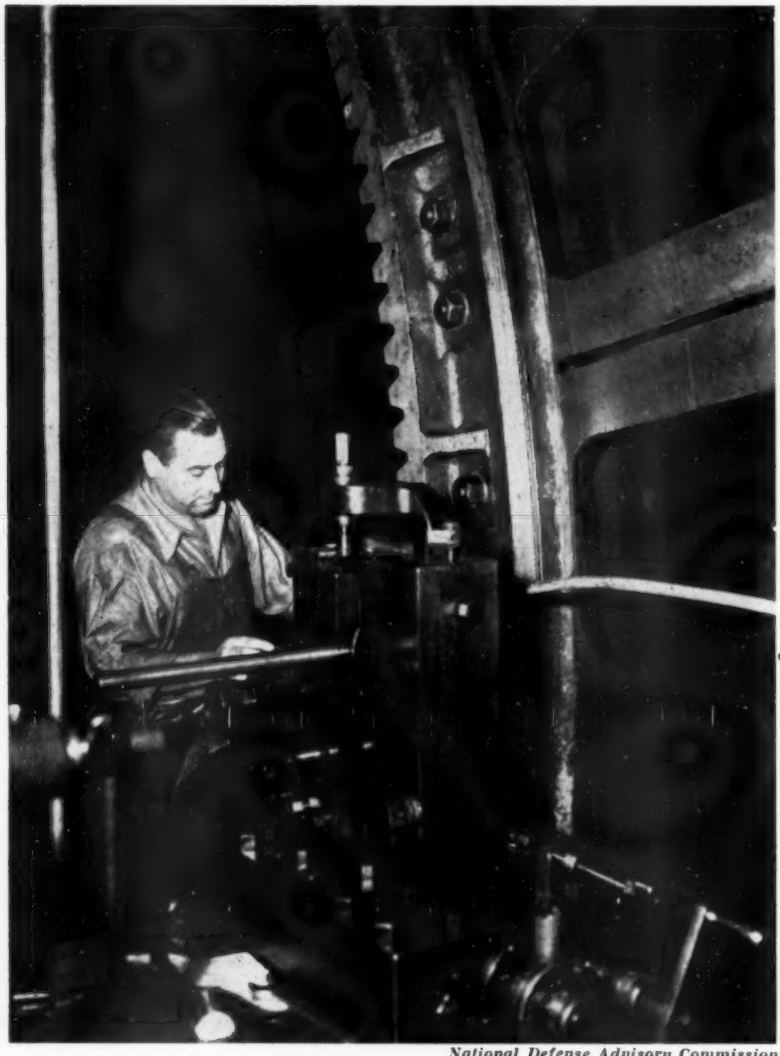
(Illustration—"Turning a Naval Turret Gun"—Courtesy National Defense Advisory Commission)

Army Ordnance Planning

by G. M. BARNES
Brigadier General
U. S. Army

With a two billion dollar fund the Ordnance department has had to plan the production and purchase of the thousands of items needed today.

WE have been watching and studying the war which is in progress in Europe with a great deal of interest and apprehension. We have learned that today nations which do not possess the proper military tools in sufficient quantities for the purposes of modern warfare are powerless to resist. We know now that Belgium, France, and the British troops on the continent were not defeated through the use of secret weapons. We know that Germany defeated France because she possessed an overpowering quantity of the modern tools of war.



National Defense Advisory Commission
At the Watertown Arsenal
Gears are cut for a 16-inch gun carriage elevating rack.

The resistless attacks of the German army did not surprise the military men of France and England who were aware of the great plans for preparedness under way in Germany. These officers, however, were unable to influence their governments to get ready for the conflict which it was evident would soon occur.

According to our studies, Germany spent the equivalent in American currency of approximately $40,000,000,000 per year on her munitions efforts. Throughout this period Germany reversed her economic policies and rationed civilian needs in favor of munitions. In this country, up to the present time, we have rationed national defense in favor of commercial activities, except in actual times of war.

Today we may be utilizing as much as twenty per cent of our industrial capacities for national defense and in comparing our efforts up to the moment with those of Germany, we must remember that over a five-year period Germany rationed civilian needs even more severely than we now ration national defense.

Munitions Program Since 1918

Reviewing briefly the status of our munitions program since the Armistice in 1918, the Chief of Ordnance

has been given the responsibility by law for the design, development, procurement, inspection, issue, and maintenance of all Ordnance equipment. His shopping list consists of some 1,200 major items and approximately 250,000 principal components. All of this equipment is non-commercial in character and has been designed specially by the Ordnance Department to meet the requirements of the military service. It covers a wide range of items from the small shoulder rifle of the infantryman, all types of machine guns, various types of ammunition for the small arms weapons, such as ball, tracer, incendiary and armor piercing ammunition, all types of artillery, the small 75-mm field howitzer, the 75-mm gun and 105-mm howitzer pertaining to the division, the 4.7″ gun and 155-mm howitzer pertaining to the Corps, the 155-mm and 8″ howitzer for army artillery, and the 240-mm howitzer, 8″ and 14″ railway mounts assigned to the GHQ. It includes all types of anti-aircraft artillery, the machine gun, the 37-mm automatic gun, the 3″ and 4.7″ anti-aircraft guns. The list includes all kinds and types of fire control equipment for all weapons such as quadrants, telescopes, sight mounts, range quadrants, directors, remote control mechanisms, fuse setters, all kinds of armored automotive vehicles including scout cars, light tanks, medium tanks, heavy tanks, aircraft armament, machine guns, automatic cannon, all types of bombs and bomb fuses, and so on through this great list which makes up the panoply of a modern army.

Status of Munitions in 1918

When the Armistice came in 1918, American industry had achieved the quantity production of munitions. Our orders in the main were continued for about two years to enable American industry to readjust itself to civilian pursuits. At that time we had equipment available for a large army of three to four million men, and could have easily produced equipment for a very much larger army if the war had continued.

As the years passed, this equipment became largely obsolete, although many types of weapons made then are still in current use. Practically all chemical munitions such as powders, high explosives, primers, and fuses have deteriorated so as to be unfit for use.

Funds Available for Ordnance 1920-1938

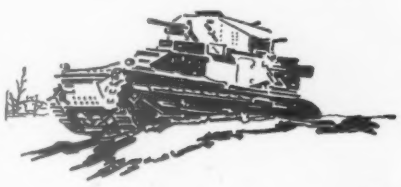
During the period 1920 to 1938 the average appropriation of the Chief of Ordnance was approximately twelve million dollars annually. These sums were sufficient to enable the Department to maintain its six manufacturing arsenals, the Proving Ground, and to keep the art of manufacturing munitions alive in this country. Fortunately, these funds were also sufficient to permit a fairly well balanced research and development program under which all types of munitions supplied by the Chief of Ordnance were redesigned and the necessary drawings and specifications made available for use.

General Barnes
He is worried about the panoply.

In 1938 we can measure the growing interest of apprehension of the American people in national defense through the increased appropriation given that year. This appropriation of fifty million dollars has since been converted into finished munitions which have been issued to the training centers. In 1939 we note further concern of our people over the situation in Europe as the appropriation that year was raised to 130 million dollars, and this sum has likewise very largely been converted into equipment and issued to the rapidly expanding army.

Last September (1940) we obtained the first great emergency appropriation when two billion dollars was made available to the Chief of Ordnance for the purchase of fighting equipment. The total program for all military supplies was 6.5 billions of dollars. I am very happy to be able to state that within six weeks after obtaining these funds, practically all of the money had been placed through letters of intent, or contracts, with American industry. This would have been a task impossible for any American business concern to carry out in so short a time. It was not an unexpected effort to the Ordnance Department which had been planning for just such an emergency for many years. Industrial mobilization plans had been made in which the country had been divided into thirteen ordnance districts and regular officers stationed in these districts had been surveying industry and making studies with industry for the manufacture of this equipment. The actual drawings and specifications have been issued to selected manufacturers for their study and these manufacturers had spent considerable sums of money in preparation for war procurement. As a consequence, before the appropriation was received, the Ordnance Department had its plans made as to the facilities which should be utilized for the manufacture of its equipment, and it was known through the production studies which concerns were the ones best equipped to manufacture these various items. Thus, after the middle of September when authority for negotiating contracts was given to the Chief of Ordnance it was possible to throw a blanket of orders over the country in a very short time.

Today, American industry is tooling up for the masss production of munitions. This is a period which it is very difficult for the layman to understand since the orders having been



placed, it is expected that production will start.

American manufacturers tool for production more thoroughly than do those of other countries, but on the other hand greater production is obtained with the same number of men and machine tools. As you gentlemen so well know, the thoroughness with which this tooling up process is accomplished determines ultimately the degree to which maximum production will succeed.

New Arsenals

In addition to the effort made by the Ordnance Department in placing these orders with American industry, it has been necessary at the same time to carry out a program for the construction of approximately forty new arsenals at a cost of 600 million dollars. These arsenals will manufacture components of munitions not ordinarily obtainable in sufficient quantity with the peace time facilities existing in this country. For example, it has been necessary to build a number of additional powder factories, since the quantity of smokeless powder made in the United States in time of peace would not support a war effort. The present daily capacity in the United States for powder is 50 tons per day. Three new plants will increase this to about 600 tons per day. The same may be said of small arms ammunition, and so a number of small arms ammunition plants are being constructed. Other plants are being built for the manufacture of essential chemicals and explosives, such as ammonia, T.N.T. and tetryl.

Tank Arsenal

As the mighty tank arsenal (top) which the Chrysler Corporation will operate for the Government nears completion, machinery is moved in (center) ready for installation as soon as possible. Plant engineers (below) develop the layout of the plant in which the 25-ton tanks will be made. The building is 500 feet wide and 1380 feet long. By early fall five tanks a day on a one-shift basis will be coming off the assembly line. There will be 66 tanks in process on the assembly line at one time.

Photos Courtesy
National Defense Advisory Commission

The loading of ammunition is a hazardous operation and is ordinarily carried out at government establishments in time of peace. Today, six new loading plants are being built where the components of ammunition such as shells, fuses, primers, boosters, detonators, and shell cases will be brought together and loaded into complete rounds of artillery ammunition.

In the city of Detroit a great tank plant is being built by the Chrysler Corporation for the mass production of medium tanks. This is probably the only tank plant in the world which has been built from the ground up and tooled for the mass production of tanks.

New Programs

You will probably be interested to know what additional programs are likely to be approved for the manufacture of Ordnance equipment. The sum of two billion dollars referred to above was for the manufacture of equipment required by an army of approximately 750,000 men. A number of step by step additional programs have been approved so that the objective today is for the critical equipment for an army of approximately 1,800,000 men. By "critical equipment" we mean those items which cannot be quickly manufactured such as tanks, artillery, and ammunition. Additional orders will therefore be required which will bring many new facilities not now engaged in the manufacture of Ordnance into the national defense program. These establishments will require tooling for production, and additional tooling will be required at most of the plants already having orders. In addition to the above programs, it will be necessary to add requirements of the British war office to those of our own under the Lease-Lend Bill. Thus, altogether the Ordnance program will be tripled.

Tool for Production

The orders for the two billion dollars worth of munitions having been placed, the work of tooling for quantity production is now underway. I do not need to tell this group of the importance of this phase of the work. The Ordnance Department never tells an American manufacturer how to tool for the production of munitions or how to execute manufacturing operations. The Ordnance Department furnishes the manufacturer with a contract and the necessary drawings and specifications.

We also have opened the doors of all our manufacturing arsenals where similar material is being manufacturned on a small scale. The technical information which we have collected during the years concerning the manufacture of this equipment is available to all manufacturers. The responsibility for tooling for mass production remains with the manufacturers.

What Is Needed for National Defense

Time

Time is of the essence in war. It cannot be appropriated by Congress. A million dollars worth of munitions today may be worth one hundred million dollars worth of munitions available next month. Great Britain greatly needs our war supplies immediately. We lack time.

Production

We must secure early production. All members of the industrial team, labor, and management, must work together toward a common goal—the earliest possible production of munitions.

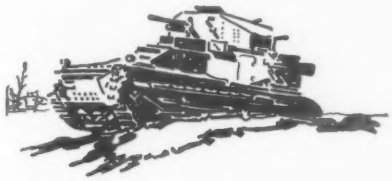
Machine Tools

Everywhere I go I find that manufacturers need additional machine tools. Some manufacturers state that if they could obtain 30 to 40 machines, and in some cases, only 3 or 4 machines, they could start production. In most cases, these wants cannot be fulfilled. A great contribution could be made to National Defense in assisting manufacturers to find ways and means of securing production with the tools at hand or the tools now in existence.

Priority

National defense must have higher priority in industry. Germany started rationing civilian needs five years ago. In this country we work best under voluntary controls. It has been my observation that when the American People understand the necessity of a situation, they will approve government imposed restrictions. Industry must give National Defense orders higher priority and precedence in the shops.

This national defense production job must be completed quickly. We have the greatest potential munitions capacity in the world. Let us use such part of it as is necessary to complete the requirements for critical military supplies as required by national defense at the earliest possible moment.



Naval Ordnance Planning

by JOSEPH A. DAVIES

Chief Planner and Estimator
Naval Gun Factory, Washington, D. C.

When the projectile to be fired weighs about a ton the gun must be well made and carefully planned—here's how the navy makes their 16-inch turret guns.

THE following general plan of action precedes the placing of orders for manufacture or contracts for procurement from commercial firms:

(a) The General Board of the Navy, composed of high ranking Naval Officers, recommends to the Secretary of the Navy, the quantity, caliber and model of the guns and other ordnance units for installation on the ships.

National Defense Advisory Commission

Torpedo Station
A finishing cut is taken on a turbine wheel at Alexandria.

(b) The Secretary of the Navy directs the Bureau of Naval Ordnance to prepare plans and estimates for the President's budget for presentation to the Congress of the United States for enactment of the necessary legislation and appropriation of funds for construction of the naval armaments approved by the Congress.

The Bureau of Naval Ordnance keeps in close contact with the problems under consideration by the Naval Affairs Committee of the Senate and the House of Representatives and proceeds with the tentative plans. The Officers and Civilian Ordnance Engineers of the Bureau of Naval Ordnance prepare designs for new or modified ordnance units.

Handling of Contracts

The Naval Bill, having been passed by both bodies of Congress and signed by the President of the United States, is now ready for definite action by the Navy Department.

The orders for the naval ordnance units, authorized by the Act, are immediately prepared by the Bureau of Naval Ordnance and sent to the Naval Gun Factory at Washington, D. C. for the manufacture of procurement of the units under cognizance of this organization.

The Bureau of Naval Ordnance places contracts through the Bureau of Supplies and Accounts for all rough machined gun forgings with the large steel companies such as Bethlehem;

Midvale; National Forge and Ordnance; and other firms, and contracts for fire control instruments, motors and hydraulic gear with commercial concerns specializing in the manufacture of these units.

The Bureau of Naval Ordnance has direct cognizance of the Naval Gun Factory at Washington, D. C.; the Torpedo Station at Newport, Rhode Island; and the Naval Ordnance plant at Charleston, West Virginia; and also new plants now under construction in Canton, Ohio; Detroit, Michigan; and Louisville, Kentucky.

It is the policy of the Bureau of Naval Ordnance to procure as many ordnance units as possible from commercial sources, expanding firms in

Chief Planner Davies
Photographed by THE TOOL ENGINEER at his desk in the Naval Gun Factory.

many cases, and to construct and equip government-owned plants for the units which cannot be obtained in time to meet the completion dates of the ships under construction. At present the Bureau of Ordnance has out about one-half billion dollars in contracts. The government-owned plants are constructed, equipped and operated by carefully selected commercial firms, special attention being given to management, engineering, and mechanical experience on comparable production work.

I will not attempt to tell you Tool Engineers how tools should be designed for rapid production of parts and assemblies as the capability of the Tool Engineer, as proven by the development of the automobile, is well known to the civilized world.

I am confident you will not follow in the footsteps of the designers as described by Ken Lane-Winthrop in the *Boston Post*.

The Designers

The designer bent across his board
Wonderful things in his head were stored
And he said as he rubbed his throbbing bean
"How can I make this thing tough to machine?
If this part here were only straight
I'm sure the thing would work first rate;
But t'would be so easy to turn and bore,
It never would make the machinist sore.
I better put in a right-angle there
Then watch those babies tear their hair.
Way down in here where they're hard to tap
I'll put the holes that hold the cap.
Now this piece won't work, I'll bet a buck
For it can't be held in a shoe or chuck
It can't be drilled or it can't be ground
In fact the design is exceedingly sound."
He looked again and cried, "At last!
Success is mine, it can't even be cast."

Planning Methods

I will now give a brief outline of the planning methods followed at the Naval Gun Factory, which were adopted after an exhaustive study by three of the foremost industrial engineers and while many of the details have been modified due to changing conditions, the general plan of organization is still in effect and has been found very satisfactory.

The system is a modification of the Vickers system with central office analysis of work, as far as the major steps are concerned, and the preparation therein of essential preliminary papers. The purposes of this system are to secure earliest practicable beginning of work, to prevent an undesirable accumulation of material in shops, and to properly follow up work to secure best machine tool results.

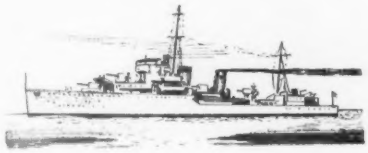
The Planning and Estimating Section analyzes requested work into its principal steps, prepares job orders, auxiliary or shop orders, material lists, stub requisitions for drawing material from store, prepares requisitions for the purchase of special material by the Supply Department which is not carried in stock, and makes estimates of time and cost of work.

The aim of the system is to revise downward and to simplify instead of amplify details in planning and paper work. The system recognizes planning as essential only in so far as it provides clear and definite specifications for auxiliaries or job orders. eliminates ambiguity as to what is to be done and where, and provides drawings and material promptly. The aim is to expedite estimates and give the upper limit instead of the possible lowest cost so that actual results will never exceed the estimated cost except for wholly unforeseen causes.

The following will give an idea of some of the problems involved at the Naval Gun Factory:

A five-inch anti-aircraft gun and mount weighs about 24 tons and is composed of 2700 different parts. The jigs, fixtures, and gauges required to produce 15 mounts per month will cost about $350,000.

We manufacture approximately 250,000 different parts which must be interchangeable any place in the world. These parts are required for fuses, telescopes, torpedoes, torpedo and gun directors, and torpedo tubes, in addition to the principal activity of producing guns, mechanisms, mounts, and sights from 50 hundredths caliber to 16″ guns and mounts. None of these parts except fuses are produced in large quantities, and it is frequently necessary to change the set-up of the



machines and shift the workmen from one job to another to meet the needs of the Service.

No time studies, by means of a stop-watch or other device are allowed at navy yards, and the estimates of time and cost for the production of parts must be made by men familiar with the methods followed by the shop supervisory force and the available machine tools and other shop equipment. The planners and estimators are selected from the several trades in the yard and are assigned to the class of work which they have been following in the shops. These men are required to have had at least six years' experience as journeymen in the trade they will be assigned for planning and estimating purposes in the Planning Division.

Planning Personnel

It is the practice in selecting planners and estimators to have the Shop Masters recommend several men who are interviewed by the officials of the Planning Division, attention being given to practical experience at the trade and also education, especially on engineering subjects which will have a bearing on their work in the Planning Division.

The personnel in the Planning Division consists of approximately 60% planners and estimators, and 40% clerical employees, including stenographers; clerks; typists; etc.

The accuracy of our estimates is remarkable when we consider that no time studies are allowed and the accuracy of the estimates depends on the practical knowledge of the estimators and close cooperation with the shop supervisory force.

Under normal conditions the difference between estimates and actual cost, considering all jobs completed in one year, amounts to less than 5%. This does not mean that all jobs are completed within 5% of the estimate as some are high and others low, but in the aggregate they tend to balance each other, resulting in practical agreement between estimates and actual cost figures.

It is obvious that the Naval Gun Factory, with a maximum capacity of 15,000 employees, manufacturing a very limited quantity of each part, cannot use production lines and methods followed in the manufacture of automotive equipment or other units produced in large quantities.

Special Tooling

The Naval Gun Factory fabricates these units with a minimum amount of special tools, gauges, and fixtures by using highly skilled all-round machinists. The ordnance work being sent out on contract has been tested at the proving ground in actual use in service and found to be efficient and satisfactory and if the parts and assemblies are produced in accordance with the specifications, dimensions, and tolerances as shown on the blueprints, our new ships will be supplied with the best armament possible to be produced at this time by any nation. When necessary to change from small lots to large production lots, the Tool Engineer becomes a very important factor in the building program as it is necessary to design tools, jigs, and fixtures for the production of naval ordnance in larger quantities in a limited time with machine operators who have little or no training on ordnance work. However, a machine operator capable of making a part for an automobile within a tolerance of one-thousandth part of an inch can readily be trained to produce a gun part to a similar tolerance, provided, tools, fixtures, and gauges similar to the ones he has been using are supplied for the parts.

I will take as an example a gun breech housing which is being manufactured in Detroit. The rough machined nickel steel forging weighing 6,000 pounds is furnished by the Government and after finish machining weighs 3,000 pounds. This part is a very high class of machine work and the Naval Gun Factory uses 126 special tools, drill jigs, and fixtures with very few gauges.

The following machines are required to manufacture one housing every twenty-four hours: Ten 5″ spindle horizontal boring machines; three 3″ spindle horizontal boring machines; seven 30″ x 40″ x 90″ milling machines; three Keller automatic profiling machines; two 36″ stroke slotters; two 30″ stroke shapers; two radial drills; two 36″ x 12′ planers; two 6′ draw-cut shapers.

The total time required for the machine work is considerable and the Naval Gun Factory has a maximum output of 25 per month. Six-hundred and seventy of these housings have been manufactured over a period of nine years. I have visited the Detroit plant having a contract for 1,000 of these housings and find they are designing and manufacturing or procuring approximately 250 jigs, fixtures,

National Defense Advisory Commission

Naval Gun Factory at Washington
Manufacturing the tube for a 16-inch naval gun.

and special tools and arranging machines to produce these housings at the rate of 30-35 per month. It will be very interesting to the Government to know the reduction in the machine hours due to the use of specially designed tools and production methods developed by the Detroit firm.

The Government is constructing a plant in Detroit for the manufacture of ordnance parts and sub-assemblies for final assembly at the Louisville, Kentucky plant.

Nearly all of the ordnance work to be procured from commercial or new government plants for the Naval Expansion Program is now being made

National Defense Advisory Commission

Naval Gun Factory
Drop-forging a part of a small gun.

at the Naval Gun Factory, Washington, D. C. for ships due for early completion. The Bureau of Naval Ordnance and the Naval Gun Factory are prepared to furnish information in regard to tool design and show the work in process to representatives of the firms having contracts for similar work as a guide for their tool and production engineers.

Operations

I will now describe in more detail the manufacturing operations required to produce naval guns, taking as examples 5" anti-aircraft and 16" turret guns. The manufacture of Naval guns may be divided into two principal classes:

(a) The manufacture from a single forging which is radially expanded by applying a very high internal hydraulic pressure, approximately 80,000 pounds per square inch at the breech end decreasing to approximately 45,000 pounds per square inch at the muzzle end. This method stresses the gun forging in excess of the elastic limit of the steel and gives a permanent set to the metal adjacent to the bore and when the pressure is removed places the material surrounding the bore of the gun under compression. The 5"/38 caliber anti-aircraft gun is an example of this method of construction.

(b) The manufacture by using a number of forgings and building up the complete gun by the assembly of these parts by a process of heating to a determined temperature in order to enlarge the bore and placing the parts in their proper location, allowing them to cool and seize an inner member through shrinkage of the heated forging. The 16" turret gun is an example of this construction.

The sixteen-inch/50 caliber naval guns are about 800 inches long and weigh, when finished, over 100 tons and require 6,000 hours to finish machine from the rough machined forging.

This is a built-up gun consisting of alloy steel forgings, namely: liner, tube, jacket, hoops, and locking rings. All parts of the gun are assembled by the shrinkage process with the exception of the locking rings.

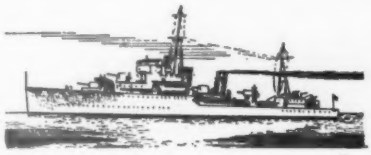
45 Ton Gun Tube

The tube is the principal longitudinal member of the gun, extending the full length from the breech face of chamber to the muzzle. The rough machined forging of the tube, as received by the Naval Gun Factory, is about 65 ft.long, weighing about 45 tons. This forging is placed in the gun lathe and three steady rest bearings are turned true with the bore. (2) The forging is then placed in the boring lathe and bored by the use of pack bits. The pack bits are constructed with a forged or cast steel body with the width approximately ten-hundredths less than the diameter to be bored and 90 inches long. The diameter of the bit is built up on each side of the body by using oak lumber about five inches thick of sufficient width to allow for turning to the proper diameter. Two cutters of Tungsten Tool Steel are firmly fixed to the forward end of the pack bit, adjusted to the desired dimensions, and the wood is then turned in a lathe to the diameter to be produced by the cutters, plus 12 thousandths of an inch. A pack bit is run from the muzzle end for 1/3 the length of the tube. The forging is then reversed in the lathe and bored from the breech end with a pack bit for 1/6 of the length.

The rough bore is then tested with a dial indicator mounted on the end of a long telescopic tube placed in the bore, giving a plus or minus reading in thousandths of an inch. A telescope enables the observer to read the illuminated dial face. If the bore shows more than 3 thousandths runout, the diameter of the bit is increased to correct the error.

(3) Bore the remaining portion from breech end with a pack bit. The operator measures the shoulder left by the previous operation and begins a cut with a light feed to insure concentricity with the previous boring. The bore is again indicated and if not true, the diameter of the bit is slightly increased. (4) The boring is continued in a similar manner with additional pack bits and we then have a tube bored with several different diameters. The bore of the tube is reamed to a continuous taper, which I will describe later.

The tube is then rough turned to within 5 hundredths inches of finished diameter, then turned with a broad nosed tool with 1½ inches feed and a 3 thousandths taper per inch to the required diameter which allows the proper shrinkage for the hoop and jacket. The correct dimensions are determined by carefully star gauging the mating parts which have been finish bored with the same taper. Some of you may not be familiar with the use of the star gauge and I will briefly describe the construction of this instrument which is essential for accur-



ately measuring the internal diameters of the parts necessary in the construction of guns.

Use of Star Gauge

The star gauge consists of a head at the end of a long tube with three metal points extending radially through it. These points are removable and are made in different lengths to suit the bore of the cylinder to be measured. The bases of the points are held in contact with a cone inside of the head by the use of coiled springs. When the cone is advanced by means of a rod passing through the length of the tube, it forces the points radially outward, the amount of movement being read on the vernier on the handle of the rod. The zero mark of the vernier is checked by testing with a standard ring gauge.

The hoop is the first forging to be assembled on the tube. The hoop is first subjected to a slow heat and then lifted from the heating furnace with the crane and carefully located in line with the tube which has been placed in the shrinking pit in a vertical position with breech end down. A three way point gauge is run through the heated hoop while suspended over the tube to check, prior to assembling, whether or not the hoop will pass freely over the tube. The heated forging is then lowered on the tube until the shoulders in hoop and tube are in contact. The hoop shrinks very rapidly after removal from the furnace and could not be assembled on the tube if the allowed time to cool were exceeded. The jacket and remaining hoops are assembled in a similar manner and after cooling the gun is conically bored for the liner with taper pack bits. These taper bits are constructed similar to the pack bits previously described, except the cutting edges are designed to cut the entire length of the bit similar to a taper reamer except they have but two cutting edges located on opposite sides of the bit.

When the tapering operations are completed, we have a tube with a conical bore. The conical bore of the tube is carefully star gauged and the liner turned to the proper diameter, allowing for proper shrinkage. The assembled gun is then heated, placed in the shrinkage pit and the liner lowered until the shoulders contact.

Pressure is applied by means of a hydraulic jack to hold the liner in contact with the shoulder during cooling. Water is circulated through the bore of the gun as a cooling agent.

After cooling, the gun is finish bored and the breech end chambered and machined for the gas check seat and the threads chased for the screw box liner. The bore is then lapped with emery paper, removing all tool marks to a dimension of 16 inches; these dimensions being determined by star gauging the full length of the bore.

The rifling consists of grooves of a right-hand twist, one complete turn in a predetermined length. These grooves are cut by pushing a rifling head containing adjustable cutters ground accurately to the contour of the groove. These tools are secured in a rifling head mounted on a bar having a key-way milled to the required lead to give the proper rotation to the head during the rifling operation. This head is passed through the gun as required for each set of rifling grooves. A constant stream of lard oil and kerosene is forced between the rifling head and the bore of the gun to insure removal of cuttings and smooth grooves.

One Ton Projectile

The breech mechanism consists of a step plug threaded to suit the screw box liner, the smallest diameter step being left blank to allow assembly of the breech plug and screw box liner. By designing the threaded portion of the plug and screw box liner properly, it is possible to have the threaded portion sufficient to take up the shock of the powder explosion, which equals about 18 tons per square inch. Back fire is prevented by the mushroom pad and gas check rings. The pad being made of a composition of asbestos and tallow covered with canvas. The breech is opened by rotating the plug and dropping with a hinge motion to clear the bore. The gun is loaded with a projectile weighing about a ton, forced home with a motor operated rammer. Powder is placed in the gun chamber and the breech closed and locked by an air operated cylinder and plunger. This gun has a range of approximately 20 miles.

My remarks have been limited to the ordnance equipment required for new ships for the Navy, but national defense, under the present emergency, involves every phase of industry and all citizens of our country which is now faced with an unprecedented foreign peril and demands a swift and driving increase in our armaments.

U. S. Navy

Battleships in Formation
The completed turret guns are trained in practice maneuvers.

Are You Up Against PRODUCTION PROBLEMS?

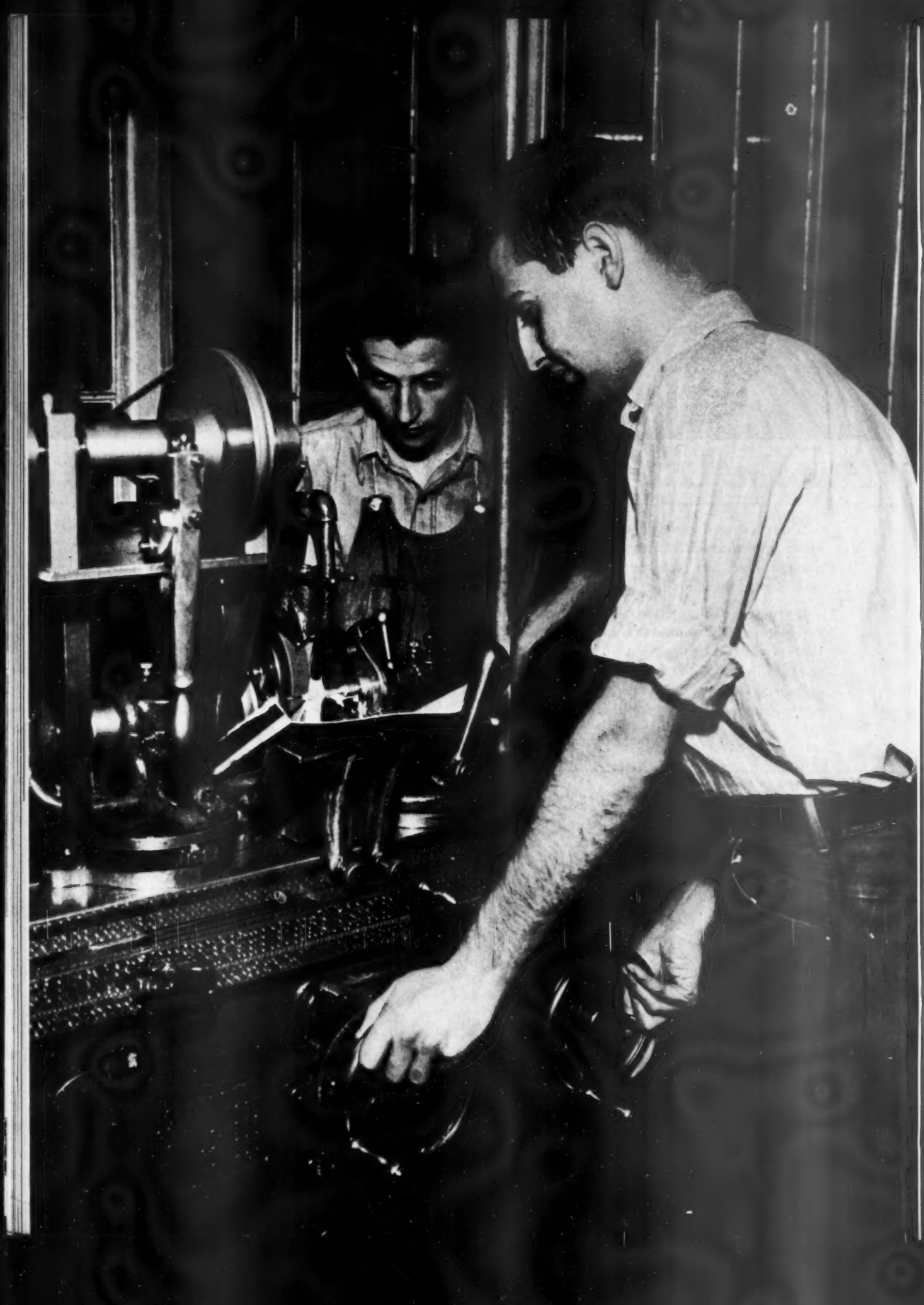
Unprecedented orders and "defense priorities" make immediate deliveries of turret lathes out of the question. Yet, you are probably confronted with urgent demands for greater output.

If you are in this predicament, Warner & Swasey can help you. Do you realize that you may increase your production from 30 to 60% on your present turret lathes with the installation of new Warner & Swasey Turret Lathe Tools? These tools will improve your methods—permit full use of carbide cutters and greatly step up your production. This at least is a partial answer to your problem. Our Engineering Service Department will be glad to study your jobs and make recommendations.

Another way we can help you—make better workmen out of your present operators! We have established a Turret Lathe Operators' Service Bureau to help you train new men. Older operators can benefit, too. All this service is yours for the asking. Write Warner & Swasey, Cleveland, Ohio.

YOU CAN TURN IT BETTER, FASTER, FOR LESS WITH WARNER AND SWASEY TOOLS

Get More Production from Your Present TURRET LATHES!



PART IV
EDUCATIONAL REQUIREMENTS

THERE is more to production than plans, machines, tools, and tooling. All this is really no more than the preparation, the foundation from which production rises. Labor, properly skilled and in sufficient amounts, is essential to mass production. In a decade of unemployment like that just past, skills grow rusty and the aptitudes of youth go untrained.

The inauguration of our Defense Program found industry faced with a shortage of skilled labor. Unless this shortage could be filled all other preparations would go for naught. The seriousness of the situation was early recognized by Tool Engineers and through surveys the shortage was brought to the attention of industry in general.

Thus the problem was foreseen in time and industry, working in cooperation with boards of education, has had time to work out a solution. Thus in this part of our analysis we are able to present two very specific instances in which labor needs have been met through a cooperative plan for education and industry.

The men so trained are not skilled in the sense that a man with years of experience is skilled, but they do have enough basic knowledge to understand their place in the production program and enough skill at one particular operation to serve satisfactorily in that specialized niche.

The satisfactory solution of the educational problem results from cooperation between industry and education—two groups traditionally more or less at odds—and is indicative of the potentialities of this nation when united in a common cause.

It is a heavy responsibility America has accepted. An "arsenal of democracy" cannot be lightly considered or easily built. It requires sacrifice upon the part of all; cooperation by all groups and classes.

As the "key men of industry" it requires of Tool Engineers unselfish and untiring work in tooling for defense requirements and in training men to fill the production lines of democracy. It requires a United America for successfully continuing the one ideal upon which all America stands united: "For what avail the plough or sail, or land or life, if freedom fail?"

(Illustration — "Apprentice at Springfield Armory" — Courtesy National Defense Advisory Commission)

How Connecticut Solved the Training Problem

by CARL A. GRAY
President, The Grenby Manufacturing Co.
New Britain, Conn.

Unemployment may be government's problem—but employment is industry's problem and in Connecticut that problem has been solved successfully.

IN telling you about the work we have been doing in Connecticut, I want to go back to two years ago when we first started. Like so many manufacturers and business men, I had my qualms of conscience about the many problems that beset our country. I felt, as no doubt many of you have felt, that something ought to be done about it, that as American citizens, entirely aside and apart from politics, we, the responsible civic-spirited business and industrial men of our respective communities might be doing something worth while if given an opportunity.

I had observed, as we all have observed, the wasteful processes of relief and the various efforts of government to cope with the matter of unemployment; the millions of dollars spent without making a dent in the problem; skilled hands allowed to become skill-rusty; the unskilled and inexperienced unable to gain experience in order that they might be worth more to themselves and to the community; millions spent to promote indolence and teach people how to become unproductive minded. I had come to the conclusion that the reason we were getting nowhere was that we were tackling the wrong problem; the problem was and still is not unemployment but employment. We had attached entirely too much emphasis in this country to unemployment and to unemployment "relief" and not nearly enough emphasis had been placed upon employment which would tend to lessen "relief".

National Defense Advisory Commission

Apprentices at Watertown Arsenal
The unproductive and indolent mind must be put to work.

It was just two years ago this month I tried to submit to some important officials in Washington a plan which if broken down into communities, would have given business, working in harmony with government, a chance to do something about the great problem of unemployment. I am not going to pretend that it was then a matter of national defense. I lay no claim to having been so foresighted as that. But it was a plan to cope with a matter of almost equal magnitude. However, to make a long story short, I could not arouse any interest.

But I found that the Governor of Connecticut was interested.

No one, I might say, was more surprised than I, when Governor Baldwin in April, 1939, asked me to accept the Chairmanship of the present Commission to study Employment. I did not hesitate to accept, for it seemed to me that right at home was an opportunity to try out in Connecticut the idea I had hoped to sell Washington officials. If it worked, it might be useful to other states. I suppose I should mention the fact that I, as Chairman, and all other members of the Commission served without pay; no appropriation for the work of the Commission was made by the General Assem-

bly, not even for postage, or a stenographer, or telephone bills.

Today the necessity of a sound industrial training program is obvious. But back when we first started, prior to the war, or before there was much concern about national defense, a real selling job had to be done to get anyone to do anything about it. This in spite of the fact that the trend of the last six or seven years had shown a marked declining tendency of skilled hands.

I am not unmindful of the many good things industry does but says little about. On the other hand, I know American business has been on

Emergency Educators
Bartley Whiteside, Herbert Hall, Carl Gray

the defensive for it has passed through an experience which has shaken the self confidence of many business men. We lived in the presence of a popular movement which had placed in office politicians who, if they were not openly hostile to industrialists, certainly had no love for them and by innuendo and other means, took advantage of every opportunity to belittle the things that American industry stands for. Now, in addition to this, when it comes to public relations, American business with all its genius, is very weak—and the engineers are no exception. Bureaucrats have capitalized on this weakness no end, and it seemed to me back in those days, that it was time for business to look more fully into the social implications of an unemployment situation which had lasted so long and do something about it.

Problem of Employment

Good will is created by action and not by gestures such as billboard advertising or pledge cards. But help a man to find himself—help him into a job in private industry—and you have an investment in good will that money cannot buy.

The Connecticut plan calls for the close cooperation on a basis of mutual good will and understanding of government and business. We fortunately have such a relationship in Connecticut. You may substitute for that now if you will, the present national defense emergency. Now, today, you will get that same cooperation regardless of differences of opinion, because of the emergency and because business and industry, patriotically will do their utmost to cooperate with the defense program.

In considering the problem, we decided properly speaking, the problem of unemployment might be government's problem, but the problem of employment—and that was what we were interested in—was not and is not government's problem at all. It is business and industry's problem. Business and private industry are the only ones that can rehire and employ these people. Government may plan away until it is blue in the face, but all of its elaborate plans and projects will come to nothing unless in business and private industry, there are jobs. Who should know better than the business men, the engineer, where these jobs are, what the requirements, standards, qualifications, should be?

So, in Connecticut, with the full cooperation and backing of the Governor, we launched our program by selling the business men in all parts of the state, the idea of active and sincere participation in an employment program. When it comes to civic and community interest, the manufacturers particularly are not difficult to enlist.

I might add one more thing. In Connecticut, for 300 years, local communities have insisted upon running their own local affairs. We believe in our state that the home folks know best what is best for the home folks. That, I might say, is a particularly good rule to follow when dealing with industrial and employment problems. After all, if you are going to put people to work you are going to have to put them back to work where they live, for the most part, in local shops, factories, industries and on farms, and you are going to have to meet local conditions.

The Connecticut plan can be divided into 3 parts: 1—an analysis of the employables by communities, classified by experience and background; 2—a survey of types of jobs—jobs turnover—needs of industry by communities. 3—Organization of local committees of business men and other interested citizens who have the will to do something about it.

I will not go into the details of our surveys which were made in all the communities, except to say that the first surveys we made two years ago showed very clearly we had a situation on the one hand, a majority of unemployed, good people who wanted to work but had no particular training. One-third of them were youth, 16 to 25 years of age, many of whom had never had a real job in their lives—many were only 9 years old when the depression started and had only known relief checks in their homes. Another one-third were in older groups, people who were under equipped for life work. On the other hand, our job surveys showed that there were jobs open needing men who could qualify for those jobs. It does not take long to make these surveys for with the aid of the State Employment Service within two months we had sufficient facts to give us the picture. Rather than make exhaustive studies and print fancy booklets with beautiful graphs as most commissions do that have money to spend, we decided to do something about it. (We didn't have any money to spend for printing anyway).

The Connecticut plan has for its basic premise the principle that employment is an intensively local problem. The job training program, therefore, is not one program but many

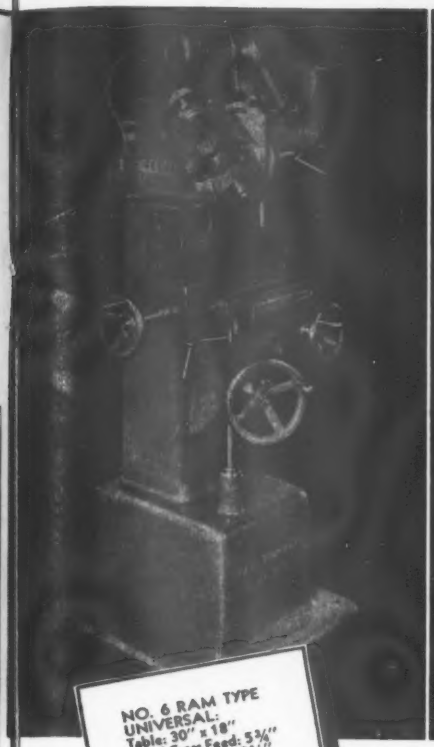
VAN NORMAN builds this complete line of seven modern milling machines, each one designed to reduce job-time and errors, build up output and quality, simplify set-up and control, and provide smoother operation on the heaviest cuts. This line includes new models of the well-known Van Norman Ram Type Universal Millers, featuring the adjustable cutterhead and sliding ram which combine their adjustments to permit quick changes from vertical to horizontal to angular milling with a minimum number of reset-ups . . . with only the standard types of milling cutters and without attachments.

The line also includes Horizontal Plain and Universal Models . . . and the new Van Norman Handmill. To analyze the savings and improvements which these machines can bring to your work, write today for complete illustrated bulletins.

VAN NORMAN MACHINE TOOL COMPANY

Springfield, Massachusetts

VAN NORMAN MI



NO. 6 RAM TYPE
UNIVERSAL:
Table: 30" x 18"
Hand Cross Feed: 5¾"
Ram Movement: 9½"

NO. 12 RAM TYPE
UNIVERSAL:
Table: 37" x 8⅛"
Feed Range:
17" x 6⅝" x 17"
Ram Movement: 12¾"

HAND MILL (PLAIN):
Table: 26" x 6"
Speeds: 160—1100 rpm
No. 40 Nat. Std. Taper

NO. 2-L, PLAIN &
UNIVERSAL:
Table: 45" x 10"
18 Speeds: 30—1450 rpm
12 Table Feeds: ½"—36"

NO. 22-L, PLAIN &
UNIVERSAL:
Table: 45" x 10"
Range: 28" longitudinal,
10" cross, 16" vertical

NO. 2-S, PLAIN &
UNIVERSAL:
Table: 50" x 12"
18 speeds: 25—1250 rpm
18 Feed Changes

LLING MACHINES

STARRETT METAL CUTTING BAND SAWS

Starrett

FLEXIBLE BACK — METAL CUTTING

Band Saws

CUT TO LENGTH AND WELDED

It's easier to order STARRETT BAND SAWS

Get the right metal cutting band saws for your work by specifying STARRETT. Available in 12 widths (1/16" to 1"), 4 gauges, 8 pitches, 3 tempers and 3 sets — in coils of any length or cut to length and welded — all to make it easy for you to use the most efficient and economical band saws. Made of special tough alloy steel with exclusive STARRETT heat treating and tempering processes and the most modern tooth milling and setting machines to guarantee unexcelled uniformity and quality and long and satisfactory service. STARRETT Band Saw Folder "T" gives complete specifications, prices and useful information. Write for it.

AVAILABLE THROUGH ALL LEADING SUPPLY HOUSES

COILS OF ANY LENGTH

THE L. S. STARRETT CO.

World's Greatest Toolmakers

Precision Tools..Dial Indicators..Ground Flat Stock
Hacksaws . . Metal Cutting Bandsaws . . Steel Tapes

ATHOL, MASSACHUSETTS, U. S. A.

programs — as many programs as there are employment areas in the state.

It must be borne in mind—and I wish we could impress this fact upon those educators in Washington who are trying to establish a national training program—that employment conditions and needs common to one locality may be entirely different in another. Therefore, whatever curriculum of training is evolved, must be determined specifically to meet the needs—the defense needs of local communities.

I have had hundreds of requests for the curriculums which we use, from people in all parts of the country. But that which will meet our needs may not necessarily meet the requirements elsewhere. What is happening today is that certain educators have suddenly discovered they should have a program of defense training. So, they are setting up courses—any kind of courses as long as it sounds like training for defense. In general practical shop men are not always instructing these courses and the results are questionable. Since the Federal program started last July, we have had a number of defense training schools from other states try to place their students in Connecticut. One school had 300 men which they could not place at home, so they tried to sell them to several industries in Hartford. I happen to know that particular city in Massachuetts well enough to say that if their courses had been closely geared to their own local industry, sponsored by industry and training given by practical men, these trainees would be absorbed at home.

When we started our first schools in Hartford, for example, the manufacturers elected 6 men—most of them members of A.S.T.E.—to meet with me as a sub-committee of our Hartford Committee, and around a table we developed our first 200 hour curriculum (The 200 hours by the way was picked out of the air—there is no scientific or educational basis for it). All of these men were practical men who knew what was called for and what had to be done. That school started in one weeks time. It, of course, was not all as easy as it sounds, to get started, for we had a number of obstacles placed in our way by some of the leaders of the educational fraternity, when we suggested the use of trade school machinery after regular school hours. There is a dual control of trade schools in Connecticut, the City Board of Education controlling the building and property and the State Board of Education, the equipment and instruction. I wish to call attention to the difference between those in the educational field and those who are connected with vocational training schools. The latter gave us their full support for many of them have appreciated for many years what was needed but were not in position to do much about it. Our vocational teachers in our trade schools are practical men from industry and they have done an excellent job in helping to make our program successful. In our case, we simply told the local Board of Education, if they did not care to let us use the trade school outside of the regular hours, the local manufacturers on our committees would supply additional space and machinery. The school authorities found we were determined to start a job training school anyway, and they finally permitted us to use the trade school equipment. By using these schools after hours, we did not interfere in any way with the regular long term trade-training program.

National Defense Advisory Commission

Practical Instruction Pays

After basic training the apprentice becomes a specialist.

Cooperation Needed

As a layman, knowing little about red tape, I soon found that politics plays too great a part in our school system and in School Boards in this country. Furthermore, it would not do any harm to weed out some of the dead wood on these school boards.

When it was realized that our job training graduates were absorbed quickly by industry, and in addition were making good on the job, the leaders of education became more friendly; they discovered that industry was only trying to cooperate. The final answer to this problem was just a matter of bringing education and business to-

gether. I hope we can keep it that way.

The policy which was laid down in Connecticut from the start had incorporated in it a few important points which I believe has contributed largely to the success of our program:

First, the courses in our school originated according to the need of local industry, by practical men who know their jobs and who know what is called for.

Second, our policy from the start was to have only practical shop men teaching these courses. All of our instructors were loaned and paid for by the local industries. Today the only difference is that we are using Federal funds for salaries.

Third, this is job-training and should not be centralized in the public school system because the role of our present universal education alone, will not meet defense needs.

Fourth, all of our applicants for the schools must pass through the State Employment Service and must be passed upon in addition by the personnel men from local industry. This is important because it permits industry to set the qualifications and standards for the men it wants.

The State Employment Service in Connecticut has done a monumental job in clearing these men with industry for the answer is that we have had very few failures. The State Employment Service in our state understands the language and requirements of business, has worked in harmony with business and we have had their wholehearted support from the very start of our program.

Use of Operation Sheets

The objectives of training green men were first to familiarize the trainee with measuring tools, blueprint reading and furnish experience on various machines, the idea being to develop an appreciation of the necessity for accuracy. In what we call our basic machine shop course, the work is designed to give the maximum number of operations; the whole job is set up in operation form, the trainee working a given number of hours on each operation. At the same time he does a given number of pieces, which are carefully checked for accuracy. Operation sheets with the appropriate gauges are used on each operation, so that the trainee gets experience from the first in their use; he is then thoroughly familiar with these forms when he reaches his job in the factory. All students in these schools are on a 40 hour week basis, 8 hours a night. Most of our job training schools run at night between the hours of 11 and 7 o'clock in the morning. Right here let me say that anyone who believes the unemployed do not want a chance to work and a chance to learn, should visit these schools and watch these men in action on the graveyard shift.

If a trainee shows lack of mechanical ability, he is immediately dropped from the course and another called to take his place. The school simply notifies the Employment Service of the number it wishes to have report on a given date. Students are carefully watched and rated; some of the students who show particular mechanical ability may be graduated in

When Machine Tools CHATTER or Bearings and Gears run HOT— use "STURACO" EXTREME PRESSURE ("EP") MACHINERY OILS & GREASES

STICKING ways resulting from overloads means troublesome "chatter." A STURACO ("EP") LUBRICANT will often eliminate the trouble for it has a technically accepted load carrying capacity of over 300% more than ordinary lubricants.

Hot spindle bearings and gear heads can frequently be cooled to operating efficiency when the proper STURACO ("EP") LUBRICANT is applied.

Results from this unusual principle of lubrication have been astonishing. What is your tough problem? Write, wire or phone today!

SEND FOR this new 20 page booklet outlining laboratory research behind this genuine development.

● Work out your metal cutting problems with a STUART OIL Engineer. From the complete STUART line he'll help you choose the proper cutting oil to set you up for top efficiency.

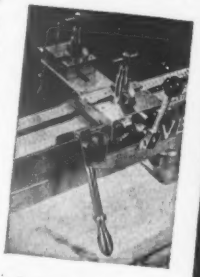
For All Cutting Fluid Problems
D. A. STUART OIL CO.
Chicago, U.S.A. • LIMITED • Est. 1865
Warehouses in All Principal Metal Working Centers

RIVETT 918 HAND SCREW MACHINE

More Precision Work

Duplicate Parts Rapidly Machined

The balanced design and operating features of the Rivett 918 hand screw machine make it an efficient producer on small precision parts. Work is accurately held in collet operated by rotary chuck closer with ball thrust bearing. Single lever controls lathe drive and automatic brake for quick starting and stopping of ball bearing spindle. Speeds from 150 to 3750 r.p.m. can be selected. Automatic indexing turret head revolves on roller bearings and is geared to independent stops. Cross slide carries tools for forming and cutting off. The machine is free from all vibration as it is properly proportioned and dynamically balanced throughout.



Parts requiring up to eight operations can be finish-machined at one chucking. Bar stock passed through spindle can be held in push-out collets up to 1" capacity while work individually chucked can be held in draw-in collets, step chucks or jaw chucks. If a turning operation is required, cross slide can be furnished with a parallel slide; see insert. Oil pump and piping is optional.

For complete information write for Bulletin 918

918 hand screw machine on metal cabinet with eight spindle speed drive.

RIVETT LATHE & GRINDER INC.

BRIGHTON, BOSTON, MASS.

less than 200 hours. It is up to the instructors to approve them. After graduation, the students are sent directly to the shops where they are placed on production machinery jobs. Some are sent to the tool rooms of local shops and from then on given specific training in the plant. We have taken men of all ages from the Unemployment ranks, from WPA, the NYA and other sources; many had never seen machines before. Our record to date shows that all of our graduates have found jobs and but very few have been dropped once placed in industry.

Courses Are Flexible

We now have 24 schools in the state turning out 2000 people every 5 weeks. This, of course, merges right into the defense program. It is being carried on by the practical men who have been taken over by the educational department and both business and educators are working closely together. Our original plan has been to give people sufficient training to allow them to have a start in industry. It was a "push them up from the bottom" idea. This not only applies to the metal trades, but can be worked out for many other vocations. From the start, we were very careful to survey all jobs so as not to over-train in any one direction.

Our courses are very flexible. We will start anything. For example, in addition to our basic machine shop course, they needed a course in riveting and sheet metal work in Bridgeport; the Sikorsky Company provided riveting machines and instructors; they needed welders in New London and Stamford; courses in welding according to Navy specification were started there. They needed finished filers and fitters at Colts, they wanted needle trade workers in Manchester, molders in New Britain and Bridgeport, and so on.

We have set up courses for women so as to train them as inspectors for the metal trades. Anything the community wants, we will at least make a stab at. Where there are no trade schools available to use their equipment, we have put schools in vacant plants and in certain going plants. For example, the Bigelow Sanford Carpet Co. in Thompsonville has an exceptionally fine machine shop, and we were permitted to use this after hours. The United Aircraft Company was so enthusiastic about the results obtained in our schools that they have entirely financed a new school, providing over $200,000 worth of machinery, 55 instructors, material to work with and the rent for the additional space. This school runs on three shifts.

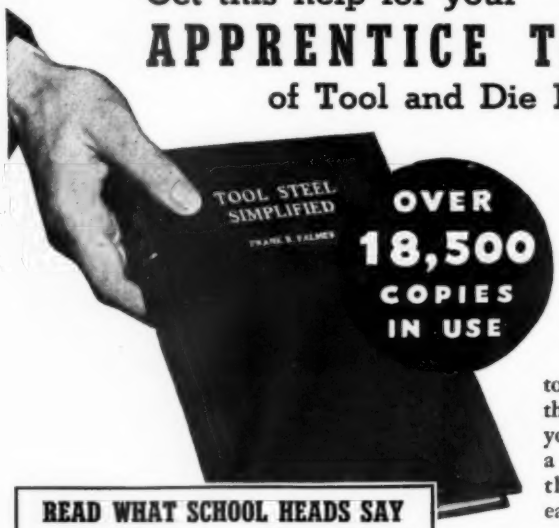
Variation Used

In the new schools, a departure has been made from our regular 200 hr. program. We are taking the cream of our 200 hr. men and are specializing them on specific machines. For example, a man will be assigned to a Bullard or a Warner & Swasey, or other machines. He stays on the particular machine until he learns to set up for special work. The course is 325 hrs. Again, if students show real progress, they may be graduated ahead of time. They learn in these courses to work

Get this help for your

APPRENTICE TRAINING

of Tool and Die Makers



● One of the recognized bottlenecks in national defense is an acute shortage of skilled tool and die makers. Are you conducting a training course or planning to start one to help solve this urgent problem in your plant? If so, here is a modern, up-to-date text that makes teaching easier.

READ WHAT SCHOOL HEADS SAY

... "Simple and easy to read. Contains useful information which commends it to technical men, semi-technical men, and men in the shops who want to improve their ability to make the best use of tools."
Prof. Bradley Stoughton
Dept. of Metallurgical Engineering
Lehigh University

... "Valuable textbook for apprentices and journeymen, and an equally valuable handbook for tool designers and others concerned with the use of tool steel."
J. B. Chalmers
Director of Training School
The Yale & Towne Mfg. Co.

... "have read and re-read the book. Became absorbed in finding out and learning so many things I never knew before. Chapter 17 on quenching is worth the price of the book... will need 45 copies for classroom use."
F. E. Laverty
Worcester Boys' Trade School
Worcester, Mass.

... "Consider it one of the very finest books that our local schools of vocational and adult education might use in training of apprentices in machine trades."
R. L. Welch
Supervisor Industrial Education
State of Wisconsin

TOOL STEEL SIMPLIFIED

By Frank R. Palmer
A Vice-President of
The Carpenter Steel Company
315 pages — 205 illustrations
$1.00 postpaid in U.S.A. Elsewhere $3.50

Now in use in many vocational and trade schools, and in apprentice courses conducted by industrial plants. Elementary enough to meet the urgent need for a good text for apprentice training. Practical enough to be helpful in advancing the skilled tool maker. Contains hundreds of practical suggestions that can be quickly applied in daily work to get improved tool performance. Send coupon below for free descriptive leaflet, or order a book for examination.

SEND Now

The Carpenter Steel Company
Dept. 4E
Reading, Pa.

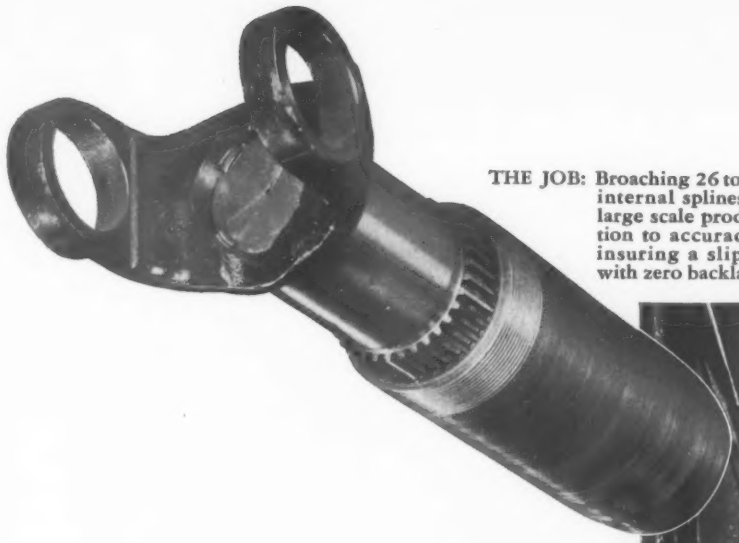
Send me free leaflet describing contents of "Tool Steel Simplified."

NAME _____ TITLE _____
(Please Print)

FIRM _____
(Firm Name Must Be Given)

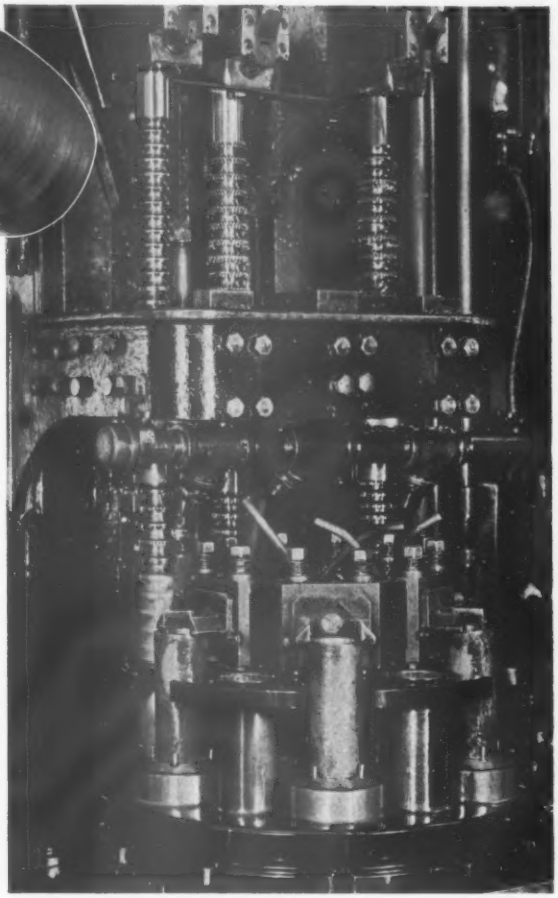
STREET _____ CITY _____

☐ I enclose $1.00. Send copy of book postpaid.



THE JOB: Broaching 26 to 38 internal splines in large scale production to accuracies insuring a slip fit with zero backlash.

THE TOOLS: 3 Colonial hardened and precision ground broaches. 1 for finishing the bore; 1 for roughing the splines; 1 for finishing the splines.



Perhaps

You Don't Need

ZERO BACKLASH SPLINES

. . . . . as Universal Products Company did for the sliding splined ends of the propeller shafts it makes for passenger cars, trucks and other automotive vehicles. Minimum backlash and long life had to be maintained in the severe service to which universal joints are subjected.

Where production of varied sizes in fairly large quantities with the utmost in accuracy is required, you too will find that Colonial Broaches —hardened and precision ground—will provide the best answer on any job where broaching can be used.

Further details are in the current issue of "Broaching News". Are you on the mailing list? No obligation. Just drop us a line.

COLONIAL BROACH COMPANY

ONE FORTY SEVEN JOSEPH CAMPAU • DETROIT, MICHIGAN

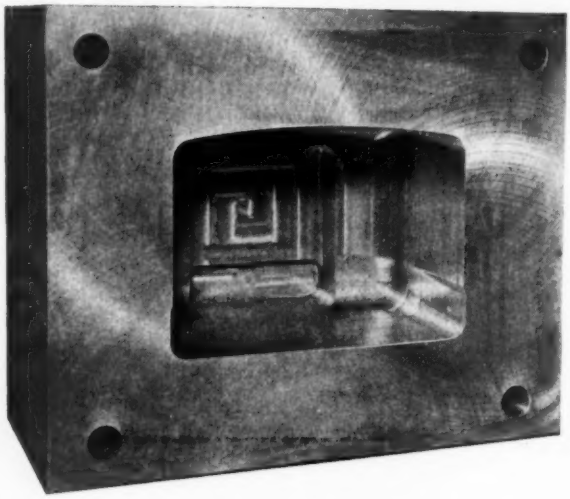
to closer limits than are required in the 200 hr. courses.

Manufacturers have found that they can give a preliminary training effectively by a joint job training school. For beginners in industry, they can train men at less expense in these job training schools obtaining good results. I would like to cite one example: When we first started our schools one large company had a man they wanted to hire as a beginner, but felt that it might be a good idea to send him to our job training school. They had expected to place this man on machine work. That man was not in our schools three days before the instructors saw he had no mechanical ability. He would probably have been injured or lost a thumb; he was a misfit and they let him out. They rated him as a conscientious worker but one who would never make the grade mechanically. Now, if that company had taken that particular man and placed him in their shop on machine work, they would have had to give him at least a few months trial before finding he was misplaced. They are too busy to give much personal attention to beginners. It would have cost them at least $300, to say little about spoiled work. In this way they did not waste that money. They hired that man later, however, as a checker and job chaser, but not on machine work.

New Type of School

I know the work of our job training schools can be improved upon. All we did in Connecticut was to get the ball rolling, so that both educators and business men know that it works and were in the frame of mind to try anything. I believe the members of the A.S.T.E. are the people qualified to lead and supervise this work. Today, we all know the need for more advanced type of training for higher skills. We have taken care of the green hands and with proper guidance in the shops, a certain percentage of them will eventually become skilled. Our new schools are providing a second and higher stage in developing skills. Now because of the emergency, I believe it is possible to inaugurate still another type of school to fill the gap in skills so urgently needed. Work which requires these skills can be classified, studied — segregated into operations—and the actual work can be done by men trained to do just one or two operations accurately and rapidly. It means teaching specialized skills and precision work. And here is where the Tool Engineer can make the greatest contribution; it takes the background and knowledge of the Tool Engineer to break these skilled jobs down into elements for which men can be trained specifically.

Training within industry — I submit, is the ideal method to train men for higher skills, both in this emergency and even in normal times. However, I question whether it will work out to meet the needs of all industries without additional community schools or cooperative school work programs for upgrading workers because many manufacturers, no matter how good their intentions, cannot afford to establish expensive training courses in their shops. Many large companies have always had excellent training programs in their shops which may



Cost Cut in Half

1/8" stock is ground from all outside surfaces of this 18" x 22" x 11" die on a Blanchard No. 18 Surface Grinder at half the previous cost.

BLANCHARD

Blanchard No. 18 Surface Grinder

Costs are vital in peacetime — production is vital for defense work — accuracy is always important. Blanchard Grinders meet these requirements — shops that have Blanchards can be *sure* of machining their flat surface work accurately, rapidly, and at lowest cost.

For most work no tooling is required, set-up time is a matter of minutes, and there is practically no lost time between jobs. The quantity of varied work that can be profitably machined on a No. 18 Blanchard Grinder is a revelation to those not familiar with this machine.

If you are interested in speeding production and cutting cost of machining flat surfaces, send us prints or samples of your work for production estimates.

This booklet, "Work Done on the Blanchard," shows over 100 jobs with production data. Send for your copy today!

THE BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASSACHUSETTS, U. S. A.

SIMPLEX Precision-built Machine Tools include 25 types and sizes of Boring Machines in both mechanical and hydraulic feeds. Planer Type Milling Machines in a wide range of models, and Special Production Machine Tools built to meet buyers' needs.

Simplex Precision Boring Machine No. 1. Two spindles.

Simplex Planer Type Milling Machine with three heads.

Series 200 Double End Boring Machine. Four spindles.

Simplex Three-way Unit Type Precision Boring Machine.

No. 1 Double End Boring Machine. Work fixture in middle.

Simplex Knee Type Precision Boring Machine.

UNIT Type Boring Machines, Single and Double End, Three or Four Way; also Knee Type and Angular Type Machines make Simplex Boring fast, efficient, and economical. Let us look over with you your precision boring, heavy milling, and special machining problems generally.

STOKERUNIT CORPORATION

MILWAUKEE, WISCONSIN

take care of their own needs. But the small manufacturer employing 25, 50, or 75 men can afford to train only a few men at a time in his shop. However, the great majority of people employed in this country are employed in these small shops, shops of less than 100 men; the large companies employing 10,000 or 100,000 employees are a drop in the bucket compared to the total employed in the small shops of this country. Big business in this country is in the thousands of little shops tucked away in the hills and valleys of every state and not confined to just a few big companies as politicians would like to have you believe. Also the trend is toward even more of these little shops rather than big ones. If you do not believe it, study the aircraft industry and figure what percentage of parts they are buying from small shops.

In Connecticut, where we have as fine a trade school setup as any state in the country, our 11 trade schools with their regular long term program only produce one-sixth of Connecticut industry's normal, annual needs. All the excellent apprentice courses and training programs maintained in the large plants in Connecticut in addition to the trade school output, would not supply the annual needs of all Connecticut industry. If we are going to supply the little shops of this country as well as the big ones, both in normal times and certainly in this emergency period, I believe the answer is in, not only training within the industry, but in community planning and community job training both in school years and after.

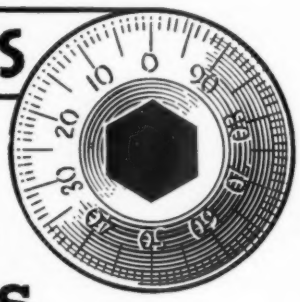
Sincere Interest Needed

A local committee of business men should and can take the matter of defense training and peace time training into its own hands. To our committees in which manufacturers predominate, were added individuals from all walks of life, educators, labor leaders, school board members, chamber of commerce leaders, civic clubs, American Legion members, etc. Anyone who would take a sincere interest and act rather than just loan his presence at meetings. While the jobs of these committees vary according to local communities, they nevertheless have three objectives: 1—short term training or job training as we call it, to give men of all ages a chance when they have missed vocational help. This can be accomplished through various forms of job training schools, also through cooperative trade school training. 2—Brush-up courses can be worked alongside of these for the skill-rusty. 3—a long term program of education. On this latter point, a committee of business men can do a great deal in the community toward helping the schools adopt a program which will prepare people to make their way in life. This applies to the secondary schools for the most part, for only 20% of the high school students go on to college.

It applies to colleges, too. We all rally when it comes to building new football stadiums, gymnasiums, athletic fields, raising money for alumni funds, etc. We do not hesitate to voice our opinion when we think the coaching staff needs revision, but actually

(Continued on page 112)

DAVIS
BORING TOOLS



Bore *STEEL* Castings as Easily as Iron!

Many machine shops think of DAVIS Boring Tools for boring cast iron only. They don't realize that our tools bore steel forgings or castings just as easily and accurately as they do iron castings. In fact, records show that DAVIS Boring Tools are boring more steel than iron! So please send us your inquiries.

DAVIS BORING TOOL DIVISION
Larkin Packer Co., Inc., St. Louis, U. S. A.

How Can You Step Up Production?

Are you, like many other manufacturers, confronted with the situation of producing something for which you are not normally equipped—requiring new dies and tools, higher plant capacity, different production layout, and a number of other changes?

Here is a staff of engineers ready to help you out of your dilemma—nearly three hundred of them — representing a very wide range of talents—thoroughly familiar with the exacting requirements demanded by government specifications to enable you to handle your problem with efficiency and dispatch. For instance, we can

- analyze your government proposals
- make estimates that are profitable to you
- make breakdowns of appropriation requirements
- develop new production tools and processes
- revamp plant layouts to effect greater efficiency
- organize new methods of handling materials

and in scores of other ways contribute the kind of help you need right now to save you undue loss of time and money, and at the same time achieve the efficiency you desire.

A discussion with our engineers should prove profitable to you.

PIONEER ENGINEERING and MANUFACTURING CO.

19645 JOHN R DETROIT, MICH.

A *New* CUTTING PRINCIPLE IN THE CAMPBELL AUTOMATIC BRINGS YOU *NEW ECONOMIES*

● The **Cutamatic** cuts more efficiently because the rotating and oscillating motions of its cutting wheel provide a shorter arc of contact. An important new principle at work—important new results made possible.

Only 12 seconds are required to cut a square inch of hard alloy steel or other difficult industrial material up to 6 inches in diameter. The **Cutamatic** smooths as it cuts—and removes all danger of burning or case-hardening the materials. It usually eliminates finishing operations.

Write for your free copy of *"Design for Cutting Costs."* It points out the way to substantial economies.

BUY ACCO QUALITY *in Campbell Cutting Machines; Ford Hoists and Trolleys; Page Welding Electrodes; American Chains; Lay-Set Preformed Wire Rope; Reading-Pratt & Cady Valves; Page Wire Fence.*

ANDREW C. CAMPBELL DIVISION
Designers and Builders of Special Machinery
BRIDGEPORT, CONNECTICUT

In Business for Your Safety

AMERICAN CHAIN & CABLE COMPANY, Inc.

How One Plant Solved the Training Problem

by BARTLEY WHITESIDE
Supervisor of Training
Wright Aeronautical Corporation

By Working in close cooperation it is possible for men to be trained in trade schools to fill specific jobs and then step directly into them.

AT the beginning of 1939 unfilled orders of the aircraft industry amounted to approximately $200,000,000; by Jan. 1, 1940 the total had risen to $621,900,000; and by Jan. 1, 1941 the total backlogs had increased to $3,700,000,000 or about six times the level of the preceding year.

National Defense Advisory Commission
Checking Cradle for 8-inch Gun
An army of new inspectors will be needed soon.

This enormous backlog of orders has created a number of extremely serious problems (1) The necessity for tremendous expansion of manufacturing floor space (2) The procurement of machine tools and equipment (3) The hiring and training of requisite personnel.

A study of the aircraft industry reveals that a major part of those producing airplanes are located along the Pacific coast, and that the engine industry is concentrated on the eastern seaboard; also that the propeller manufacturers are located in the eastern states of Connecticut, New Jersey and Pennsylvania. It is likely, however, that this geographical concentration will not continue for long. Because of the desire of military authorities to locate vital industries in locations more easily protected, there is a tendency for new factories to be built in the interior of the United States rather than near the seacoasts.

Aircraft Capacity Doubles

It is estimated that in order to meet the new demands for planes, the airplane industry will be compelled to more than double its physical plant facilities or from 9,164,430 sq. ft. to 22,170,304 sq. ft. of floor space.

Engine plants will be increased from 4,967,115 sq. ft. to 11,123,567 sq. ft. of floor space, propeller plants will increase from 398,720 sq. ft. to 1,153,900 sq. ft., or the aircraft industry as a whole will increase from 14,530,265 sq. ft. to 34,447,771 sq. ft. of floor space. It should be noted ap-

DoAll saves $500 *in three weeks*

The American LaFrance Foamite Corporation, well-known makers of fire fighting equipment, Elmira, N. Y., kept a record during a 3-weeks' period of savings effected with one Model ML DoAll. Following are only a few of the jobs done—

	Old Method	On DoAll	Saving
No. 1	15 hours	5½ hours	9½ hours
No. 2	2½ hours each	½ hour each	2 hours each
No. 3	5 hours	1¼ hours	3¾ hours
No. 4	15 hours	2 hr. 3 min.	Almost 13 hrs.
No. 5	9 hours	2 hours	7 hours
No. 6	5 hours	¾ hour	4¼ hours
No. 7	12 hours	2 hours	10 hours
No. 8	12 hours	3 hours	9 hours
No. 9	1 hour each	¼ hour each	¾ hour each
No. 10	2 hours	½ hour	1½ hours

DO-ALL
Contour Machine
BAND SAWING
BAND FILING
BAND POLISHING

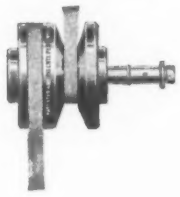
FREE—Literature and Handbook on Contour Machining, 158 pages of valuable metal working helps.

America's GREAT DEFENSE TOOL

BAND FILER
Does faster, better, smoother continuous filing on all materials from high-carbon steel to brass, wood, etc. Your choice of 21 styles of file bands, ⅛", ⅜" and ¼" wide, flat, oval or half round.

SPEEDMASTER

Provides every DoAll machine with instant variable speed—6 to 1 ratio. Also sold separately for use on any machine requiring variable speed. Ask for it.



The DoAll is the indispensable modern machine tool for speedy, accurate performance in handling scores of metal working jobs, formerly done on the shaper, lathe and milling machine. Now used in large and small plants everywhere to effect short cuts in making molds and dies, special tools and parts in the manufacture of armaments, motorized equipment, aeroplanes, battleship parts, etc.

Let us send a factory trained man to your plant to show you what a DoAll can do and save for you.

CONTINENTAL MACHINES, INC.
1304 S. Washington Ave. Minneapolis, Minn.

proximately 100 sq. ft. are required per worker for airplanes and approximately 150 sq. ft. for airplane engine manufacturing.

Many estimates of future labor requirements have been made, and all are subject to a wide margin of error. The figures presented here have been compiled from reports of individual manufacturing companies. The report of these companies show the number of each model to be made each month and the man hours of work required to produce each model. From this data, has been estimated the number of man hours which must be applied each month to fulfill the scheduled operations.

Peak Employment

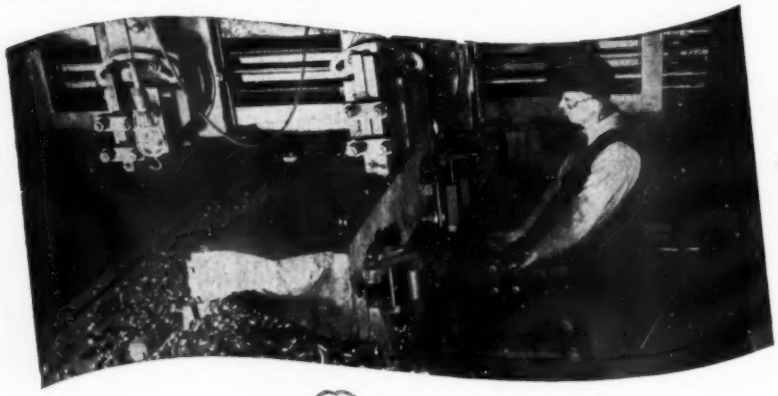
At the present time, employment in the aircraft industry is at the highest point ever reached. Employment has steadily increased for the past two years, and must expand more rapidly if the program is to be executed. In October 1940, the estimated number of workers in the aircraft industry was 203,600; by Aug. 1941 the estimated workers will be 455,500. This means that between Oct. 1940 and August 1941 a quarter of a million new workers will have to be hired and trained to meet the exacting requirements of the aviation industry. Translating these figures into monthly requirements it would mean 25,000 workers would be added each month between October 31, 1940 and August 31, 1941.

The above is an estimate of the number of employees who will be required to meet orders for aircraft, but this is insufficient. It is necessary also to examine the skills which are needed in airplane manufacture. Unfortunately, current figures on this are not available. However, on the basis of a field study made in June 1939 by the Bureau of Labor Statistics, it is estimated that in the airplane industry skilled workers comprise 41.3 percent of the total; semi-skilled 46.5 percent; unskilled 7.7 percent and others including clerical 4.5 percent. In the engine plants, 37.4 percent of the workers are skilled; 46.6 percent are semi-skilled; 9.9 percent as unskilled and 6.1 percent clerical and others.

For additional information on the vital subject of defense training refer to "How Milwaukee Trains Craftsmen", TOOL ENGINEER, Jan., 1941, p. 54; "Should Industry Assume the Burden of Special Education — A Symposium", ibid, Nov., 1940, p. 38; and "Final Report on Labor Shortage", ibid, Sept., 1940, p. 64.

How Wright Solved the Problem

In Paterson, N. J., is located the main plant of the Wright Aeronautical Corporation. This plant builds radial type air-cooled aircraft engines. With the advent of the war, and the greatly increased demand for high-powered aircraft engines, the Wright Company was faced with a problem of expansion, the limit of which has not yet been reached. This expansion began in 1939, and with it have been



"It Just Keeps Rollin' Along!"

PRODUCTION, like Ol' Man River, has to set a pace and maintain it. It's a double-edged problem for which we've been supplying answers for almost a century. There's an A-L Tool Steel that will give you *performance*—let you set a "max" schedule; perhaps even save you from expanding into more plant. And the same steel brings you complete uniformity from lot to lot; which means *schedule maintained.*

We've backed these advantages with dependable supply from stocks coast to coast, and with a Mill Service organization experienced in avoiding "trials and errors" for you. ● Let A-L Fine Steels keep you *rollin' along!*

ALLEGHENY LUDLUM STEEL CORPORATION · GENERAL OFFICES: PITTSBURGH, PA.

★ ★ ★ AL ALLEGHENY LUDLUM FINE TOOL STEELS SINCE 1854 ★ ★ ★

ALLEGHENY LUDLUM STEEL CORPORATION
Tool Steel Division, Watervliet, N.Y. Dept. T-120
Send me a copy of your new *"Handbook of Special Steels"*

Name .....

Street .....

City ..... State .....

PREPARING FOR DEFENSE

Racine Heavy Duty Hydraulic Saw in service at a U. S. Arsenal.

Racine Heavy Duty Hydraulic machine with hydraulic stop feed attachment cutting rifle barrel stock.

with

RACINE

METAL CUTTING MACHINES

The Greatest Labor Saving Development of the Year

Racine Cutting Machines at Boeing Aircraft plant cutting tubing.

- ★ All hydraulic operation — feed, rapid transverse, clamping.
- ★ Automatic continuous production. Saves 80% of operators' time.
- ★ Fastest cutting, strongest construction, guaranteed accuracy.
- ★ Modern Simplified design—Proven —Dependable.

Racine Hydraulic Saw Cutting anti-aircraft gun barrel material for a Canadian Ammunition Plant.

Write for Bulletin No. 80 .... or better still, get our complete catalog for the full Racine line .... Full range of models and prices. Hydraulic saws 6" x 6", 10" x 10", 14" x 20".

"Standard the World Over"

RACINE TOOL AND MACHINE CO.

1751 STATE STREET — RACINE, WISCONSIN

associated all of the problems incident to engineering, production and personnel. It is with this phase that I propose to deal briefly in this paper.

During the year of 1936, this Corporation had 2900 employees on its payroll, 1937 they had 3393 employees; an increase of 493; 1938 they again increased to 4342 employees; an increase of 949; 1939 they had 6661 employees an increase of 2319; 1940 their payroll showed 14,957 employees; an increase of 8296. This increase in 1940 was more than two and one-half times the total payroll in 1936. Of course, plant facilities had to increase along with the personnel.

In solving any engineering or production problem, established procedures have been developed. These procedures are well-known, and they have been accepted generally by executives of manufacturing establishments. In the case of problems dealing with personnel, the engineering approach has seldom been recognized or adopted. When we were faced with the problem of a tremendous and rapid expansion of our personnel, we realized that it could not be solved through some hit or miss procedure. Rather, we were convinced that, if it were to be solved at all, engineering techniques would have to be followed. When I say engineering techniques, what I have in mind is a critical analysis of the problem that is faced, a careful survey of the facilities immediately at hand to meet it, the availability of raw materials that can be utilized, and a production schedule that will serve as a control for carrying through the program that is adopted.

JACOBS CHUCK: 0 to ½" capacity or No. 1 Morse Taper.
SPINDLE SPEEDS: four — from 600 to 5000 r.p.m. with 1740 r.p.m. ½ h.p. single phase motor. Eight speeds — from 600 to 10,000 r.p.m. with two-speed 1740-3500 r.p.m. three phase motor with push-button control.
OVERALL DIMENSIONS: height 72", width 31", depth 58". Shipping weight 450 lbs.
BALL BEARING MOUNTED: sliding ram carried on 8 precision ball bearings with provision for take-up for wear.
SIX-SPLINE SPINDLE: four precision ball bearings. Drive pulley straddle-mounted to eliminate belt strain.
CAPACITY: permits drilling to center of 62" circle. Maximum distance nose of chuck to table 13½". Vertical traverse of spindle 3¼". Column diameter 3¼".
MISCELLANEOUS: drill may be tilted to 45 right or left. Drill press head cast in one piece. Ball bar accuracy guaranteed within all industrial standards. Extremely rigid when locked in drilling position. Minimum deflection.
walker-Turner

THE NEW
WALKER-TURNER RADIAL DRILL
PAYS ITS WAY IN ANY SHOP

At last—a Radial Drill of the most practical design and construction, for **less than one-fourth** what you have been paying for this type of machine. This useful production unit meets all reasonable specifications for accuracy within the limits of its capacity. Designed for industrial use, its adaptability makes it a **profitable investment for any shop.** The remarkably low price of **$325** (with motor) F. O. B. Plainfield, N. J., is made possible only by W-T volume production, which also permits us to offer reasonably **prompt delivery.**

SEND FOR INFORMATION

WALKER-TURNER CO., INC.
1941 Berckman Street, Plainfield, N. J.

Please send me complete information regarding the new Walker-Turner Radial Drill.

Name ..... Title .....
Company .....
Street .....
City ..... State .....

walker-Turner **WALKER-TURNER PRODUCTS**
DRILL PRESSES • LATHES • BAND SAWS • BENCH SAWS • TILTING ARBOR SAWS
JIG SAWS • RADIAL SAWS • RADIAL DRILLS • BELT AND DISC SURFACERS
GRINDERS • JOINTERS • SPINDLE SHAPERS • FLEXIBLE SHAFT MACHINES • MOTORS

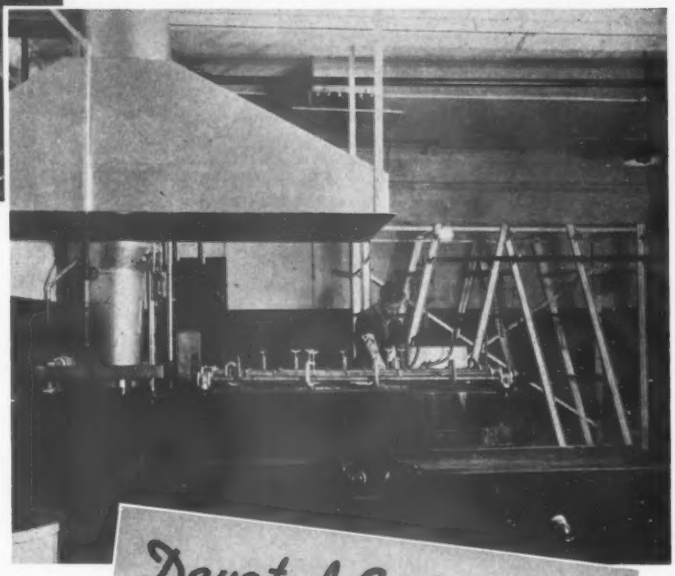
Conditioning "Green Help"

As early as 1936, the Wright Company recognized they were facing a market that would require a considerable expansion of their manufacturing facilities. After experimenting with the labor that was available in the open market, it was decided that better results could be obtained through selecting green workers, and training them in what might be called an operators apprenticeship program. The labor that was available had not been trained to meet the production techniques, and tolerances and precision that were required for the manufacturing of the Wright Engine. It was also discovered that the reconditioning of this so called available skilled help involved more effort, and production loss, than would be the case through taking green help and conditioning it from the start to meet the standards that were required.

The personnel that was enrolled in this operator apprenticeship program was classified as trainees. The avowed objective of this program was to produce competent machine tool operators. The training given these men was limited in scope to the operations and machine tools found in a particular department of the plant. While no effort was made to limit the training to a single type machine tool, neither was any effort made to transfer men from department to department. However, the foremen in the individual departments were introduced to the program that had been decided upon, and they gradually

A LINCOLN PARK *First*

West Of The Hudson

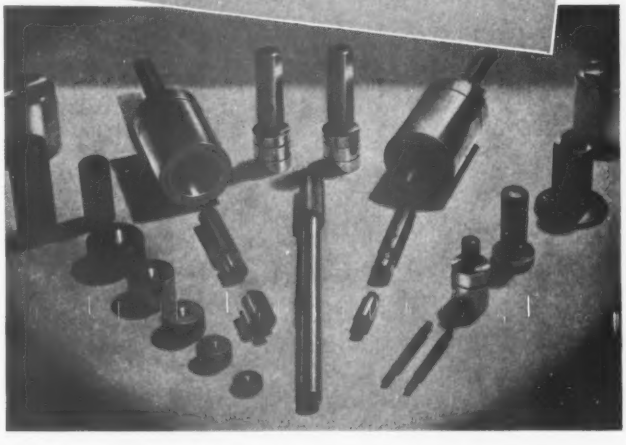


. . . It's the ONLY PLATING PLANT OF ITS KIND

Every operation necessary in the manufacture or salvaging of chrome-plated gages and precision tools is handled in the Lincoln Park plant. The plating department, which is the most modern and complete in the gage industry, is the only one operated by a gage manufacturer west of the Hudson River. Its unexcelled facilities make possible the finest hard chrome plating work.

New and improved ways to utilize chrome plating are constantly being developed by this company. Now—and in the future—the most advanced methods will be those employed by Lincoln Park.

Devoted Entirely To
HARD CHROME-PLATING OF GAGES and NON-CUTTING PRECISION TOOLS



LINCOLN PARK TOOL and GAGE CO.
LINCOLN PARK, MICHIGAN

were trained to the point where they carried it on most effectively. In addition to the actual operating experiences provided for this trainee group, the local Vocational School was asked to provide related technical training in such subjects as shop mathematics, shop science, drafting, and industrial economics.

Novel Organization

The Vocational School in Paterson is a school operated by the Board of Education of the city and is a public school. The administrative organization of this Paterson Vocational School is rather novel. Ever since the school was first organized there have been associated with it, Trade Advisory Committees, and a Board of Trustees. For each industry represented in the school there is a Trade Advisory Committee. From each Trade Advisory Committee one member is nominated to act on a Board of Trustees. These Advisory Committees and the Board of Trustees are lay bodies, and the Board of Education depends on them entirely for advice for the proper development and operation of the school. On the Metal Trades Advisory Committee, the Wright organization is represented by three men. One is our production tool supervisor, one is our production methods supervisor, and I, as supervisor of training, am the third. This Advisory organization, made up of practical men from industry, has resulted in the development of a most practical type of Vocational School for Paterson. When faced with the problem of providing related technical instruction for the trainees program for the school, it was simply a matter of following recommendations made by the Metal Trades Advisory Committee.

Public School Co-operation

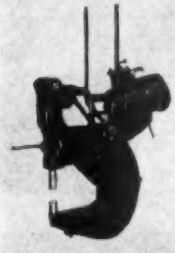
In presenting the foregoing picture of the trainee program, and the contact with the Vocational School, I have been endeavoring to lay the ground work so you will be able to understand how it was possible to meet the problems of our recent rapid expansion of personnel. In the fall of 1939, when it became apparent that the Wright Company would be faced with a tremendous increase in its personnel our critical study of the whole situation indicated that, while our trainee program had served admirably for a normal expansion, it would be too slow to cope with the situation that was developing. Our study of this situation indicated that a modified form of trainee program could be developed to meet the new condition. In place of having a man become a trainee, apprenticed to a department, it was felt that it would be more effective to substitute a system that would train a man to operate a single type machine tool. It was also felt that, in place of a program extending over a period of two or three years, during which time actual shop operating experiences and related technical instructions would go hand in hand in the plant, some form of intensive preemployment training should be developed.

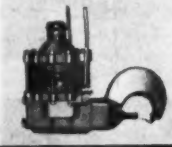
In view of the facilities already existing in the Vocational School, and of the willingness of the Wright Company to supplement the existing

Squeeze Your RIVETS FAST and TIGHT

with Hanna Squeeze RIVETERS
Pneumatic and Hydraulic

THERE'LL be no production bottlenecks in your riveting operations if you put Hanna Squeeze Riveters on the job! Here is a proved short cut to a greater volume of work per man—wherever fast, positive riveting is required. Look at these construction and operation "highlights":





- *Hanna Squeeze Riveters* drive a rivet with each stroke of the piston. The full rated tonnage is exerted throughout the last portion of the die stroke—its squeezing action causes the metal in the rivet shank to flow, completely filling the rivet hole, assuring positive tightness.
- *Portable and Stationary Types* available in over 700 styles and sizes for every type of riveting, driving hot or cold rivets from ⅛" to 2½" diameter. Riveter sizes range from 2" throat or reach, up to 21 ft.
- *To Assure Maximum Economy,* our recommendations covering Hanna Squeeze Riveters to fit your job will include suggestions as to dies, fixtures, handling the work as riveting progresses and other valuable production details.

Write today for recommendations, sending a sample or description of the work to be fabricated.

HANNA ENGINEERING WORKS
1765 ELSTON AVENUE • CHICAGO, ILLINOIS
Air & Hydraulic RIVETERS • CYLINDERS • Air HOISTS

Balanced Design

THE NO. 2-20 . . . Table 42" x 12" . . . Table travel 20" . . . wide spindle speed range with only two gear contacts motor to cutter.

Hydraulic table feed with fully automatic cycle . . . independent adjustment of feed rate for opposite directions of table travel.

TODAY it's "Meet Priorities" . . . "get out those defense jobs" . . . "watch out for bottle necks" . . . and everywhere experienced shop men are calling on Kent-Owens when the going is tough. Kent-Owens Milling Machines are rugged, simple, efficient . . . they provide the advantages and features that practical men demand.

•

Write for Bulletin . . .

Kent-Owens Machine Company, Toledo, Ohio

Call on KENT-OWENS for MILLING MACHINES

school equipment with a number of additional production type machine tools, it was felt that an intensive pre-employment training program, involving both related technical instruction, and shop experiences on a single type machine tool, could be carried on in the school. After careful study, I proposed such a scheme to the school authorities, and on recommendation of the Metal Trades Advisory Committee, and the approval of the Board of Education, it was decided to make a trial of this new venture.

This pre-employment training program, that had been suggested to the Vocational School, resolved itself into a four week course. The first week of the course has been developed for a period of intensive class work. This class work consists of four subjects, namely, shop arithmetic, shop science, reading operation sheets, and the use of measuring tools. The hours that were set for the school training program were from 4:00 in the afternoon, until 11:15 at night, with a 15 minute lunch period from 7:30 to 7:45 o'clock. This clock schedule gave a total of 35 hours per week, or 8¾ hours for each of the four subjects listed. In order that there would be no waste motion during this week of intensive class work, mimeograph lesson and home work sheets were prepared for each night for each subject. Each night, each teacher is required to grade each student on his progress. Those who fail to maintain a satisfactory standing are dropped from the program. At the close of this week of intensive class work, the student's record is compiled, and on the basis of his accomplishment he is arbitrarily assigned to a single production type machine tool. In the class subjects, a teacher is given 20 men. In the shop units, a teacher is given ten men. As is the case with the work in the classroom, each shop teacher is required each day to chart the progress of each student, and to check the operations that he has been taught. There is a cumulative record kept for each student, and this folder gives a complete history of the student's progress and ultimate disposition.

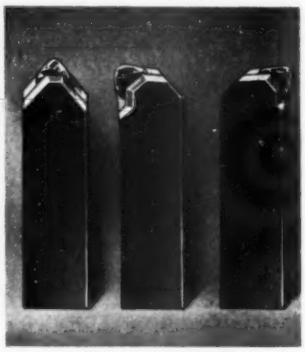
At the completion of the four weeks of training, the shop teacher is required to make an average grade for each student. It might be well to note here that, as the shop teacher discovers that a student does not have the ability to master the manipulations involved in his shop experience, he is dropped from the program. From these grades that are submitted by the shop teacher, lists are prepared giving the name, machine on which the student has been trained, the rate he attained, his date of birth, his height, and his weight. These lists are forwarded to me, and on the basis of the jobs that are available, the school is notified when to have the individual man report. The school then sends the graduate to our employment office with an introductory card, on which is entered his name, and his machine classification. The man is then started as an employee of the company, and assigned a number which indicates he has a status as a learner.

Training Inspectors

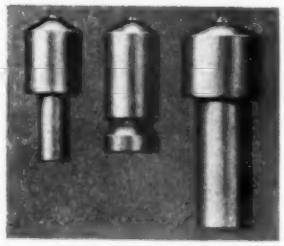
An exception to this particular routine is concerned with the training of

THE BETTER THE TOOL
the better
the machine

With an investment of several thousand dollars in a machine and five to ten dollars per day in wages for the operator, how important it is that the cutting tool be the finest obtainable. If a diamond tool costs several times as much as any other kind, it is usually an exceedingly profitable investment, for nothing else can approach the diamond in hardness and cutting qualities. This fact is doubly important today with our tremendous defense program calling for every last possible ounce of production.



Shaped Diamond Turning Tools surpass all others for speed, accuracy and finish.



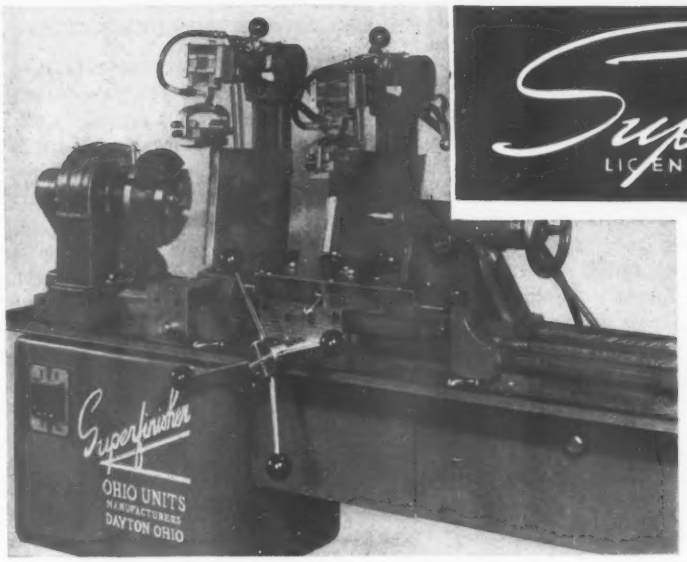
Left to Right — Landis Nib, Norton Nib, Cincinnati Nib.

Diamond Wire Drawing Die, unequalled for fast, accurate wire drawing.

Core Bits set with Bortz, used in mining, blasting, foundation and exploratory work.

And when buying diamonds for setting in various kinds of tools, or the complete tools, be sure to give careful consideration to the source. Anton Smit & Co. has specialized in industrial diamonds for over thirty years. The Company controls all steps in the production of diamond tools—mining, importing, tool making and servicing. Large stocks of Bortz, Carbons, Ballas, Cleaved or Natural points, Diamonds for Dies, Glazier Diamonds, Phonopoints, Crushing Boart, Splint Powder, etc., in all sizes and qualities on hand. Send for illustrated folder and prices or send blueprints for quotations on shaped tools.

ANTON SMIT & CO., INC.
24 STATE ST. (near Battery) NEW YORK, N. Y., U. S. A.



OHIO UNITS
Superfinisher
LICENSED BY CHRYSLER

Illustrated above is our Model 301 SUPERFINISHER equipped to do a special job. One head SUPERFINISHES the diameter of large flanges; and the other, with automatic traversing head over a long range, SUPERFINISHES the shaft bearings.

SPEEDING UP *for* THE JOBS AHEAD

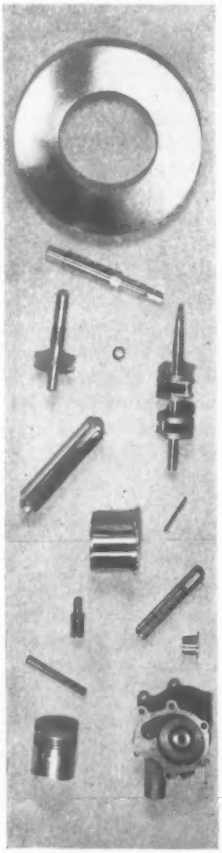
• • • •

PRECISION SURFACES

• • • •

Fine precision surfaces can be obtained in minimum time by the application of SUPERFINISHING. These machines have been developed for the jobs that you now have, or will have to speed up your production program.

The machines are unique in design in that so many types of work can be done on the same tool. It is a self contained unit with driving motor, lubricating system and the various multi-motions involved in SUPERFINISHING incorporated in a single unit. SUPERFINISHING heads may be adjusted to any desired position, and the tension of the stones against the work is controlled by a unique spring device adjustable for both internal and external work.



The above unretouched photograph illustrates some of the large variety of parts which can be SUPERFINISHED on these machines.

ADAPTABLE TO A WIDE VARIETY OF WORK . . . A HIGH PRODUCTION MACHINE TOOL

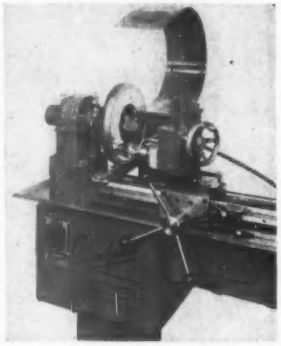
This machine for SUPERFINISHING round, flat, external and internal surfaces, has been developed for general use. The illustration to the left will show a wide variety of parts that can be SUPERFINISHED without expensive or extensive set-ups.

FOR AVIATION PARTS — TANK PARTS and, in fact, all other parts that require a fine surface finish, this machine functions almost universally.

Single heads, multiple heads, flat surfacing heads and other types of equipment make this a universal type of machine whereby we can equip it to meet your requirements for high production.

SUPERFINISHING is desirable in all lines of industrial activity.

SEND US YOUR BLUEPRINTS OR BETTER STILL SEND US SAMPLES TO BE SUPERFINISHED



The above photograph shows the clutch contact face and the oil seal at the rear of a flywheel being SUPERFINISHED. Eleven different types of flywheels are SUPERFINISHED with this one setup by one manufacturer.

We also manufacture the **OHIO UNITS MULTIPLE CAM GRINDER** which fits on practically any type of cylindrical grinder, for producing various cam shapes to precision limits on a production basis.

OHIO UNITS•MANUFACTURERS • DAYTON, OHIO, U, S. A.

inspectors. In order to meet the demands for inspection service, a program was developed that would take a certain number of the graduates from the four week program just described, and superimposing an additional two weeks of training in inspection techniques, and in routine paper work. For this particular group, the training period is six weeks, and on the completion of the training they are earmarked for the inspection department.

Previously I mentioned that the foreman had been familiarized with the technique of caring for beginners. It is here that this early foreman training demonstrates its value. The foremen recognize as beginners these men who have been graduated from the training program in the Vocational School, and have been assigned to them. There was no bluff involved, and no attempt on the part of the new worker to cover up any deficiencies or to carry through any false statements that are sometimes associated with beginning workmen. These graduates are assigned by the foremen to work alongside of experienced operators on the type machine, and on the specific operation, that they are eventually to handle. This period of partnership with an experienced operator usually lasts from two to six weeks. As soon as it is felt that the learner is competent to be given the responsibility for operating a machine of his own, the transfer is made, and the new worker is on his own. In the rate structure that is in effect in our organization, allowances are made to accommodate the limited production of the beginning worker. His percentage of unit production is set up on a graduated scale, and at the end of a fixed period he is required to come up to the production set for the particular operation.

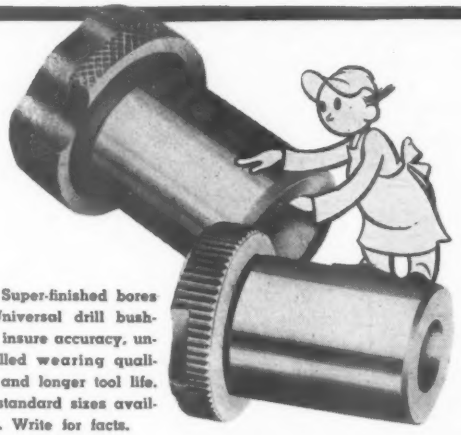
Can you answer these questions?
AN INDUSTRIAL QUIZ
What lathe has ruggedness?
What lathe has unlimited feeds and speeds?
What lathe provides accuracy?
What lathe allows heaviest cuts, free from chatter marks?
Sure, you know the answer . . .
BRADFORD
GEARED HEAD LATHES
Bradford Lathes can step up your production. Twelve selective speeds —ranging from 16 to 400 RPM—Timken Bearings or taper bronze bearings, on high carbon steel spindle—hardened alloy steel gears running in oil—quick change gear box for selective speeds and thread cutting—an unlimited range of feeds and speeds through the quick change device—accurate spindle control.
Send for Free Bulletin that gives full details and specifications
Also manufacturers of Unit Type Drilling and Tapping Machinery
THE BRADFORD MACHINE TOOL CO.
657-671 EVANS STREET
CINCINNATI, OHIO

Man Specifications

In developing this program with the Vocational School officials, man specifications that would have to be met by beginning applicants were provided by the company. These specifications include such elements as citizenship, age, height, weight, education, previous work experiences, and standards of health such as are currently required by our medical department. In order to make the screening process still more effective, a standard intelligence test, and temperament test, have been introduced. Through being required to meet the man specifications that have been set, and to have all applicants pass a physical examination comparable to that required by the company, there is every assurance that those who are admitted to the Vocational School Program would be eligible for employment, could they meet the training requirements set up in the school.

When the program was first introduced, all applications were handled through the Vocational School office. This procedure lasted from Jan. 2nd, when the first class began its sessions, until July 1st, when the National Defense Vocational Training Program was introduced. On July 1st, all referrals to the program were made through the New Jersey Employment Service. The only changes that resulted from the program coming under the National Defense Organization were, first that the Paterson

HERE ARE THE DRILL BUSHINGS THAT CUT TOOL COSTS . . .

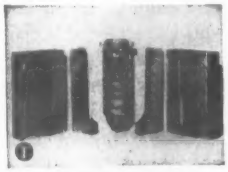


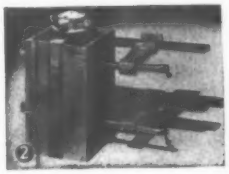
The Super-finished bores of Universal drill bushings insure accuracy, unexcelled wearing qualities and longer tool life. All standard sizes available. Write for facts.

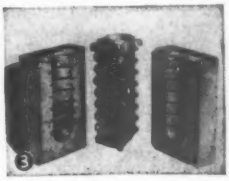
UNIVERSAL ENGINEERING CO.
FRANKENMUTH, MICHIGAN

HOW TO CUT THE COST OF MAKING CHUCK JAWS FOR IRREGULAR SHAPES

FIGURES 1 to 3 show steps in making chuck jaws with Cerromatrix, the low-temperature-melting alloy that expands slightly on solidifying. Figure 1 shows the two halves of the brass retaining shell, the two wooden spacers that support the die casting in the correct location with regard to the walls of the shell and also act as separators during the pouring of the Cerromatrix, and the die casting to be held. The plastic material in the grooves of the spacers is Babbitrite, a babbitting clay. Figure 2 shows the above parts clamped together in position for the pouring of Cerromatrix (at a temperature of 300° to 350° F.) The completed chuck jaws are shown in Figure 3. It is just as simple as that and cases are on record where time has been cut from over a week to about two hours. Savings in cost have amounted to $150 or more on a single job. Note that the jaw cavities are no deeper than necessary to hold the piece in alignment during machining. This keeps the movement in opening and closing the jaws to a minimum. Send for literature describing this and other jobs.







CERRO DE PASCO COPPER CORPORATION
40 Wall Street New York, N. Y.
British Associates: Mining & Chemical Products Ltd., London. Canadian Distributors: Dominion Merchants Ltd., Montreal

GLENCO
FLOATING TOOLHOLDER

Corrects Machine Tool Misalignment By Producing TRUE and ACCURATE Holes

Also Manufacturers of

Utility Tools

FLOATING HOLDERS
SPOTFACERS
COUNTERSINKS
REAMERS
COUNTERBORES
LIVE CENTERS
SLEEVES
TAP CHUCKS
DRILL CHUCKS
ADJUSTABLE ADAPTERS
ADJUSTABLE EXTENSION ASSEMBLIES
QUICK CHANGE CHUCKS
EXTENSION SOCKETS
SPACING COLLARS
ARBORS
END MILLS
WOODRUFF CUTTERS
CORE DRILLS

THE J. C. GLENZER CO.
DETROIT MICHIGAN

Board of Education would be reimbursed 100% from Federal funds for monies it expended for the program, and second that any restrictions as to residence were eliminated.

In view of the intensive nature of the program, and the evident need for continuity of both school training, and learner-observer, and learner-operator status, two definite policies were adopted when the program was approved in the latter part of 1939. The first was that no training would be given in the Vocational School unless there was a specific job for which to give the training, and the second was that no training would be given unless there were prospects of employment immediately upon completion of the training. The purpose of these two policies was to insure that there would be no general, or hit and miss training given, and that no public funds would be wasted on a training program that did not result in immediate employment for those admitted to the school. To carry out such policies required very close cooperation between my office and the Vocational School. As our needs for this type of beginning operator were worked out, the school was notified of the schedule, and asked to produce men from the different machine classifications at a fixed rate. As the employment situation changed in the plant, the training program was modified to meet it. Thus, if it were evident that ten external grinders, ten internal grinders, and four tool and cutter grinders could be absorbed per week, then the school schedule was adjusted to turn out that number. This same situation existed throughout all the other machine classifications.

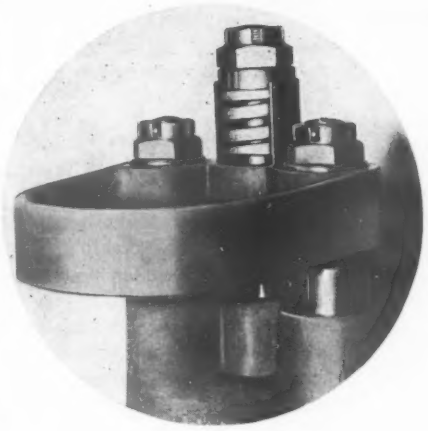
Each month a report is prepared giving a cumulative picture of the different classifications under which men have been trained, and placed in employment. A copy of this chart is available to those who may be interested in securing it.

That the training of machine tool operators has proved successful is evidenced by the small number whom it has been necessary to lay off. During the 12 months of 1940 there were over 2700 of these learner - operators trained and hired by the Wright Company. While of that number some 50 are no longer with the company, all but 16 of them left of their own accord. Those 16 it was necessary to discharge because of their inability to do the work.

Practical Instruction

One of the highly important elements that has been responsible for the outstanding success of the program is that dealing with the teaching staff. When the program was proposed to the Vocational School in the fall of 1939, and the training schedule laid out, the company agreed to release competent operators who could act as shop teachers. These men were engaged as full time employees by the Paterson Board of Education, which paid them a salary while at the same time the company continued them on its payroll, paying them a nominal wage in order to preserve their seniority, and other privileges. As the need developed for increasing or decreasing the output of the Vocational School Program, these shop teachers were re-

HAVE YOU BEEN
Hollow-Milling THE LONG WAY?
3 TIMES FASTER
With Namco
Circular Type
Multiple Cutter
HOLLOW
MILLING HEADS
4 chips at each pass
1 chip at each pass
Here's what you save..
You get 4 chips at each pass instead of one. With a self opening head, you get clean finish and a shorter time cycle. Circular cutters give you many times more tool life and fewer steps for grinds. You sharpen a set of circular mills in the tool room, quickly check them for uniformity, then one simple adjustment brings them all into final position for all diameters—no fussing with individual tools for different diameters, radii or shoulders. This saves down-time and eliminates experimental scrap loss.
You can hollow mill or thread with the same head, simply by changing cutters and blocks—"Double Duty" tools.
If you've been doing a production job the "long way", ask us to show you what Namco Hollow Mills will save and earn.
NATIONAL ACME
170 EAST 131st STREET - CLEVELAND O



SWARTZ LS TYPE FIXTURE

A spring jig with solid clamping, as built only by Swartz. A heavy die spring prevents parts loosening if heavy drill pressures force the work lower into the adapters.

ASK FOR CATALOG NO. 238

SWARTZ TOOL PRODUCTS CO., INC.

13330 Foley — **ASK FOR CATALOG 238** — **Detroit, Michigan**

Represented by

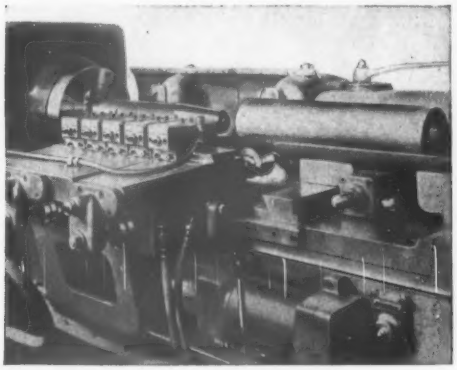
Cleveland—J. W. Mull, Jr.
Indianapolis—J. W. Mull, Jr.
Milwaukee—Geo. M. Wolff, Inc.
Chicago—Ernie Johnson
Canada—Hi-Speed Tools, Ltd., Galt, Ont.
St. Louis—Mill Supply & Mach. Co.
Beverly Hills, Cal.—Criterion Tool Sales
Houston—Engineering Sales Co.
Oneida, N. Y.—W. F. Himmelsbach
Pittsburgh—J. W. Mull, Jr.
Toledo—J. W. Mull, Jr.
Philadelphia, Pa.—Morgan Tool & Equipment Co.

MOREY "27" SEMI-AUTOMATIC SHELL LATHE

MOREY "27" Semi-automatic Lathe for rough turning 155 MM Shell. Designed to operate at the maximum feed and speed that the work and tooling will take. Loading time from conveyor belt about 5 seconds.

MOREY "27" Semi-automatic Lathe tooled for rough turning, cutting off, and facing 155 MM Shells (left). Machine shown with Logan hydraulic arbor and tailstock in loading position.

Close-up of MOREY "27" Semi-automatic Lathe (below), tooled for rough turning, cutting-off and facing 155 MM Shell. Machine shown with rough forging, ready to slide on the arbor. Loading time from conveyor belt about 5 seconds.



Machine available for actual demonstration to all interested users

MOREY MACHINERY COMPANY, INC.

410 BROOME STREET — **NEW YORK, N. Y.**

turned to the plant, or sent back to the school, in terms of the requirements of the schedule. Through having highly competent operators from the plant act as teachers in the school, it has been possible to indoctrinate the beginning workers with the ideals and the standards that are in effect in the plant. Furthermore, through following such a procedure, the transition from school to shop was made with a full knowledge of the type of experience with which they would be faced when they became employees of the company.

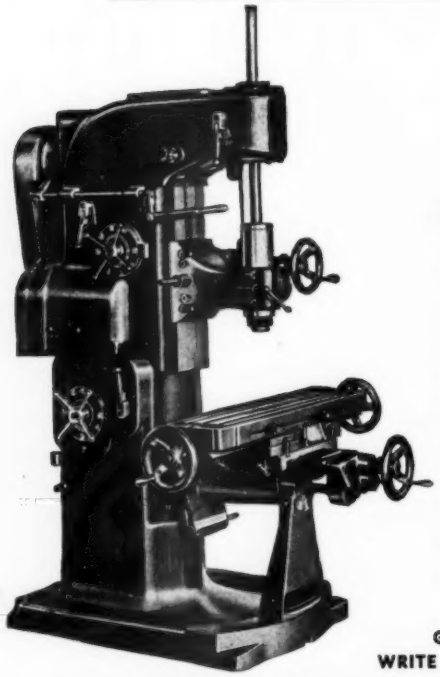
For teachers for the class subjects, the Vocational School relied upon its Day School staff, and on the production engineering department of the plant. The teachers for this particular phase of the school program were not engaged as full time teachers, as is the case with the shop units. Teachers in the class subjects teach one week out of three. While such a plan necessitated the development of three groups of teachers for this particular phase of the work, it made it possible for the men selected to continue with their regular work in the production engineering department, or in the day school.

Formula for Success

Through the success of this particular innovation in the field of employee training, it has been demonstrated that, with proper planning and organization, idle man power can be trained and conditioned to meet available employment. On the operator level, our plant in Paterson does not face any problem dealing with shortage of labor. It is our earnest conviction that this scheme which we have developed, and which has proved so successful, can be modified to meet any demand that may be made upon us.

In conclusion I would like to take the liberty of offering a formula that will insure the success of such a training program in any community. It revolves itself around the principle that industry must be aggressively cooperative in its community. Industry must be willing to cooperate in every possible manner with all agencies responsible for supporting and administering the educational program within its district. This may require time on the part of the management, donations of equipment and supplies, lending plant personnel to act as teachers, encouraging the city and school administrations, or any of a number of similar factors. In any case, industry must be willing to give generously whatever help is required. Since the Wright organization was first developed in Paterson, our management has consistently followed through such a policy of cooperation. That such a cooperative policy can produce results has surely been proved in our present situation. In spite of the stress and the strain of the tremendous expansion through which we have been passing, this policy of industry cooperating with local government and school officials has made it possible for the Wright plant to engineer a most important phase of our personnel problem to a most satisfactory conclusion.

Doing its Work for
NATIONAL DEFENSE
★ *Quickly . . .*
★ *Accurately . . .*
★ *Economically .*



★

KNIGHT-TIME
is the quickest time

• One of the many time-saving Knight Miller features is the ability to get all vertical adjustments by moving the counterbalanced spindle or spindle-head. This feature eliminates raising and lowering a large, heavy table unit for vertical capacity.

GET THE FACTS
WRITE FOR NEW CATALOG

W. B. KNIGHT MACHINERY CO.
• ST. LOUIS, MISSOURI •

When it comes to Power Bits

do these points mean anything to you?

- faster driving
- less spoilage
- no burred heads
- less tool breakage
- greater production

then these "points" should

Phillips Head | Slotted Head | Clutch Head

APEX POWER BITS are:

- made of special steel, heat-treated.
- of the right hardness to give them maximum wear resistance.
- tough—to resist the shock of the most difficult screw-driving job.
- strong—to stand up under heavy production schedules.
- machined to close tolerances for the best fit in the recessed head of the Phillips screw; the screw slot; the "keyed" head of the Clutch Head screw.

The APEX MACHINE & TOOL Company

1100 S. Patterson Blvd. Dayton, Ohio

DUAL ADJUSTABLE

Inserted-Blade Milling Cutters

for the exacting needs of the

DEFENSE INDUSTRY

TAPERED, serrated blades fit into mating slots in the cutter body. There they are immovably held without wedges, pins or set screws—yet may be quickly removed. As the slots are at an angle to the body, when these blades are set out one or more serrations, as required for regrinding, both radial and axial adjustments occur at the same time ***automatically!*** This not only saves time in moving the blades out into line of wear, but actually results in 65% blade usability.

LONGER BLADE LIFE DUE TO AUTOMATIC RADIAL AND AXIAL ADJUSTMENTS

The new blades and cutter bodies are available for either roughing or finishing. In the roughing cutter (above) the blades are inserted radially into the body and shear into the work in the direction of feed. Major wear and adjustment are on the periphery, the face of the blade merely scraping the work just cut.

In the finish milling cutter (left) the blades are inserted into the periphery and are ground with a slight lead to produce a "skiving" cut. Here the major blade wear and major adjustment are on the face. A folder describing the "Dual Adjustable" principle will be sent on request.

THE O K TOOL CO., SHELTON, CONN.

TRADE OK MARK **SYSTEM**

OF INSERTED-BLADE METAL CUTTING TOOLS

AMERICAN SOCIETY of TOOL ENGINEERS

National Officers 1941-1942

O. W. WINTER, 1st Vice-President

Born in Columbus, Ohio. Began work as machine and tool maker. Bachelor of Industrial Engineering, Ohio State University. Engaged as tool and machine designer, work analyses, time study, etc. In 1933 was in Russia as Consultant on Machine Tools. At present is Factory Manager, Columbus-McKinnon Chain Co., Buffalo, N. Y. Past Chairman Toledo and Buffalo Chapters.

FRANK W. CURTIS, President

Mr. Curtis is a Chief Engineer with Van Norman Machine Tool Co., and is a member of the executive board of that company. He has a wide experience in nearly all phases of Tool Engineering, has written several text books on the subject and contributes frequently to the technical press. He was instrumental in establishing both the Pittsburgh and Springfield, Mass. Chapters.

RAY H. MORRIS, 2nd Vice-President

Born in Turners Falls, Massachusetts. Apprenticed as machinist, employed in several Springfield plants. 1916 he joined Pratt & Whitney and 1920 became sales, service engineer in Chicago, Buffalo, Rochester, St. Paul. 1932 joined Hardinge Brothers—now Vice-President with them. Has served The Society as Chairman of Hartford Chapter and in many other ways.

CLYDE L. HAUSE, Secretary

Born in Athol, Massachusetts. Came to Detroit, Michigan in 1920, connected with the Gorham Tool Company. Worked for this company since in capacities of lathe operator, shop foreman, final inspection, estimating, engineering, buying and sales. Joined the A.S.T.E. in 1932 and has served as Chairman, Detroit Chapter, in 1940, which won National Membership Cup.

FRANK R. CRONE, Treasurer

Mr. Crone is re-elected to the post of Treasurer of A.S.T.E.—his sixth consecutive term. He is a charter member and at present is employed as Chief Tool Designer at Lincoln Motor Company, Detroit, Michigan. He served overseas and has been a tool designer or Engineer with such companies as Saxon, Doble Steam Car, Studebaker, Cadillac and Maxwell.

FORD R. LAMB, Executive-Secretary

Mr. Lamb is a charter member of The Society as well as a Past-President. To his able direction are due, largely, the tremendous success of the three A.S.T.E. Shows, and the unparallelled growth of A.S.T.E. He is a hard working Executive and knows his job from the ground up having been a practical Tool Engineer, a teacher of tool designing and an inventor.

Machine and Tool Progress Exhibition Most Successful in A.S.T.E. History

With a total attendance of more than one hundred thousand and a registration of nearly forty thousand individuals from industry, the show was the largest of its type ever held in the United States and the largest yet sponsored by the A.S.T.E.

TOOL ENGINEERS *came*, they *saw* and they *conquered*. Nearly forty thousand strong they *came* from every section of the United States and from Canada as well as from foreign countries as evidenced by individual registrations of men in mechanical industries who came specifically to the show because of their interest in mass production or defense work. They *saw* over two hundred and fifty exhibits of the very latest in tooling processes, machinery, methods and equipment of all kinds which are the working tools

Detroit Wins Membership Cup
President d'Arcambal, Membership Chairman Felten, Chapter Chairman Hause, at the presentation.

of their profession. They *conquered* through the many technical and educational sessions, through the many instructive exhibits and through many contacts, many of the toughest problems facing them in the national emergency defense production now in the process of tooling. More remote yet in the consciousness of every one of them, no doubt, they were conquering the enemies of democracy in conquering these problems of production.

Prior to the opening of the Machine & Tool Progress Exhibition at Convention Hall on March 25th in the city of Detroit, there had been those who openly stated the exhibition would not or could not be held because of the press of urgent business of Tool Engineers and others in industry who could not spare the time or who did not sense the importance of exhibiting their equipment in "times like these." The tremendous success of this, the greatest, Machine & Tool Progress Exhibition is now a matter of history and those who had looked upon the prospects of such an Exhibition as "untimely" and of dubious value or importance were amazed at the unprecedented attendance of the more than one hundred thousand individuals who passed through the portals of the mammoth Convention Hall, and also at the magnitude and number of educational exhibits put on by the various manufacturers and governmental agencies who participated.

There were those who had not exhibited who stated simply, they "couldn't believe it—they wouldn't have believed that such an enormous attendance or so many exhibits could have been possible." There were others who expressed dire regret because of their lack of exhibits in such a phenomenal show. There were others, too, among the exhibitors who expressed extreme satisfaction with the number of sales resulting from their exhibition efforts. One manufacturer

President Scott (left)
The President of Van Norman flew out to congratulate the new President of the A.S.T.E., Frank Curtis.

stated frankly that he sold $50,000 worth of his equipment during the show—another expressed his complete satisfaction with having sold one thousand machine tool motorized unit attachments, while many reported selling their machines right on the floor of the Hall.

Visitors, most important in the success of any industrial exhibition, expressed their complete satisfaction and surprise with the comprehensive exhibits, and their interest in the technical sessions and displays of army and aircraft and navy items as well as the many other phases of the convention and meeting.

Among the educational displays of

Exhibit Chairman Shuler (left)
His job well done, Frank Shuler chats with Homer Bayliss, Chairman of the Navy Night Symposium.

ordnance items were several models of Allison liquid cooled airplane engines, and an unusual display of the Hamilton Standard propellers showing the variable pitch mechanism, Ford "Blitz Wagons", Dodge reconnaissance cars and the Packard Marine engines (pictorial, production story—see p. 49, January 1941 TOOL ENGINEER) for Uncle Sam's Mosquito fleets.

Probably the most unusual display booth at the Show was one demonstrating the drilling of hardened tool steel with a specially designed drill. Material as hard as Rockwell 56 C was drilled in the demonstration which attracted many of the visitors who had heard of it and stopped in

At the Preview Dinner
Brig. Gen. Pickert, Wilkerson of General Motors, E. W. Dickett, retiring Vice President, Frank Crone, Treasurer.

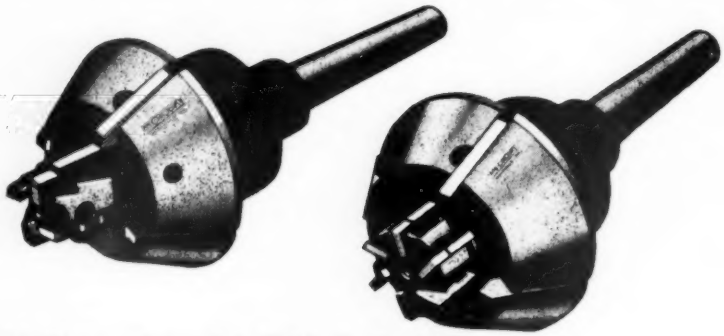
at the A.S.T.E. Host Booth to inquire about its location.

From the crowded lobbies of the four entrances to the huge Hall where the number of registrants was so great, at times, that it was impossible for the large clerical staff to handle them, to the highlight of the Convention Week when "Tool Engineer Hall" tore up President d'Arcambal's notes at the annual dinner, it was great fun, yet serious business and highly educational for all. There were many strange yet interesting episodes from the two "bewhiskered gents" of A.S.T.E. with heads together, to a display of pulchritude as had never before been seen at an A.S.T.E. Show. Miss Michigan, prize beauty contest winner was on hand to greet Tool Engineers for one manufacturer. So popular was the "main street" of the convention that one observer said it should have been called the "Broadway of the Production World",—thus indicating the scope of the equipment presented and the interest centered from all parts of the country. Another interesting sidelight was the unusually frequent combination of fathers and sons who attended the Show. Also the enthusiastic reunions of Tool Engineers from Connecticut who had traveled to California and returned to Detroit to renew old friendships of those who had come to Detroit from Connecticut. Said one of these visitors—"I haven't seen so many fellows I used to know all in one place in my whole life." Many Tool Engineers brought with them their wives who were interested spectators at the exhibition.

Highlight of the week was the annual dinner at the Book Cadillac Hotel Friday evening, March 28th at which more than seven hundred Tool Engineers were present. The new National Officers of the American Society of Tool Engineers were introduced and inducted into office. Retiring President d'Arcambal was on this occasion presented with a life-certificate of membership, and Mrs. d'Arcambal was presented—through her husband—a silver coffee service.

All in all it was a most successful event and we are glad we were among those present. We wouldn't have missed it.

CUTTING COSTS
by combining cuts . . .



McCrosky JACK-LOCK Combination Tools

COMBINED in the McCrosky JACK-LOCK special purpose tools shown above are inserted blades for multiple boring, for hollow milling, for facing, and for chamfering. The powerful and compact JACK-LOCK Wedge allows ample room for all blades needed for smooth operation and permits sturdy body sections and abundant chip clearance . . . Plus features are individual adjusting screws behind the blades and blade serrations ground from the solid after hardening . . . Let McCrosky engineers submit a layout of the JACK-LOCK Tool that can cut your costs by combining cuts.

Ask for McCROSKY CUT COSTS Bulletin No. 15-F

McCROSKY TOOL CORPORATION
MEADVILLE, PA.

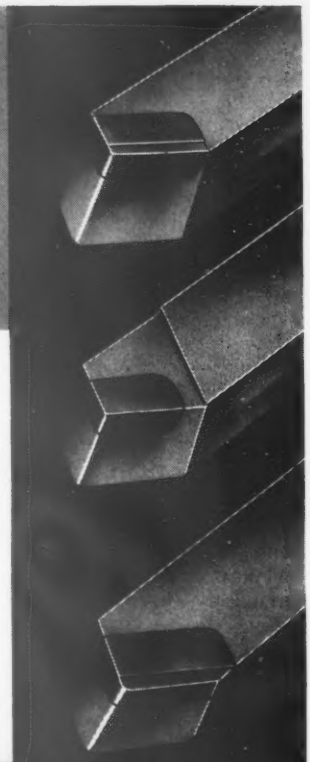
HOW CONNECTICUT SOLVED TRAINING PROBLEM

(Continued from page 92)

we give very little thought to the kind of coaching our students are getting when it comes to preparation for a life of usefulness. As tax payers, it is our duty to give serious thought and see to it that we get action rather than allow people to be dumped onto society with the idea that if they are not prepared for a job, the government will support them anyway. The balance of students—or about 80% in high schools—look for jobs when they graduate. In Connecticut, we found that over 50% of our youths between the ages of 16 and 25 who were unemployed, left high school a 16 years. What happens? Some of them leave school because of family reasons, some leave because they want to do mechanical work. In our state they cannot be employed in manufacturing until they are 18 years old so generally if lucky, they get part time odd jobs, such as cutting grass, grocery stores, messengers, etc. Such jobs

Facts for machinists

—and proof of production speed-up... lower fabricating costs, when you use TECO *Carbide Cutting* TOOLS



MACHINING steel 4 to 11 times faster than high-speed steel ... delivering 10 to 50 times as many pieces per tool ... FACTS like these prove TECO Carbide Cutting TOOLS can do your machining job in less time, at lower cost. Production increases as high as 75% are reported, with floor-to-floor time reduced 30% to 50%. TECO's diamond hardness increases tool life some 200% ... means lower machining costs, lower fabricating costs all down the line! Let a Tungsten Electric engineer demonstrate these savings in your plant.

There is a standard grade of TECO METAL to meet the characteristics of almost any machinable material. Ask for a shop demonstration without obligation. For information concerning special applications and specific recommendations, address

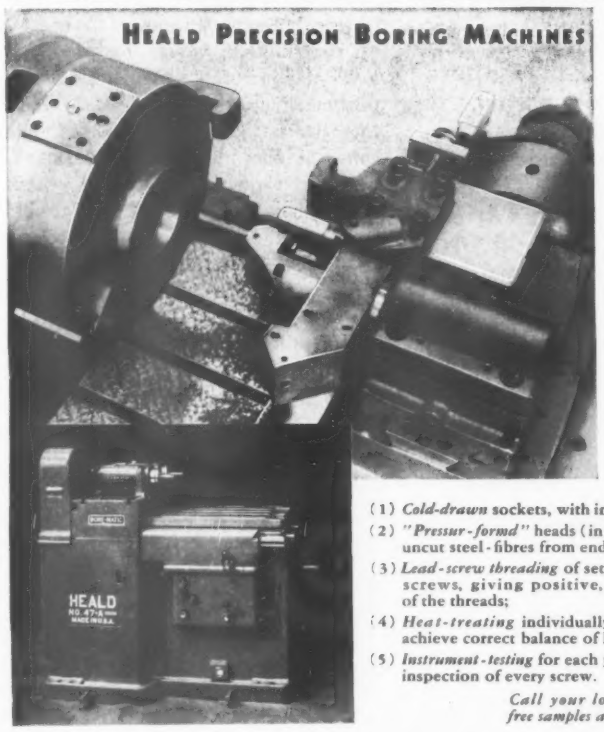
Tungsten Electric supplies carbide blanks, tools and bits. Wire and bar dies, tubing, extruding and sizing dies. Also special tools, such as spot facers, reamers, combinations, broaches, form tools, etc.

PROMPT, EFFICIENT, SPEEDY
TUNGSTEN ELECTRIC SERVICE
means more to you now than ever before.
CONSULT US

TUNGSTEN ELECTRIC CORPORATION • 570-39th STREET, UNION CITY, N. J.
Branch Office: 2900 EUCLID AVE., CLEVELAND, OHIO
Pioneers in Tungsten Carbides for Over a Quarter of a Century

TECO CARBIDE TOOLS *pay dividends!*

HEALD PRECISION BORING MACHINES



achieve Structural Rigidity *by means of* ALLEN PRECISION HOLLOW SCREWS

HEALD Precision Boring Machines meet the challenge of present necessities for speed-with-precision operation. In such highly developed and hard-driven machines, you look for *and find* ALLEN Hollow Screws locking together the units and parts with almost the rigidity of a weld!

In hard-to-hold assemblies and set-ups, design engineers for 30 years have commissioned ALLENS to stand the assaults of vibration and *extra* strains. Allens now "uphold the day" by virtue of:

(1) *Cold-drawn* sockets, with increased density of metal in the socket-walls;
(2) *"Pressur-formd"* heads (in Cap and Shoulder Screws), with continuous uncut steel-fibres from end to end of the screws;
(3) *Lead-screw threading* of set screws and *"duo-process"* threading of cap screws, giving positive, uniform friction-bearing on entire length of the threads;
(4) *Heat-treating* individually according to size and style of point, to achieve correct balance of hardness and toughness;
(5) *Instrument-testing* for each physical characteristic, plus hand-and-visual inspection of every screw.

Call your local Allen Distributor for free samples and accommodating Service

THE ALLEN MANUFACTURING COMPANY
HARTFORD, CONNECTICUT, U. S. A

may only be good for a few months.

These men, if they do not find jobs, learn to flounder and many will be found still floundering without vocation after they are 40 years old. All things being equal, two men—one older and one younger, without any training, industry naturally will take the younger man. But the men who have trades, irrespective of their ages, today are in jobs. A man who knows his trade at 48, as we all know, is in his prime. Manufacturers do not discriminate against the man who knows his job.

Present Schools Limited

There should be a longer school period and our schools should not only give a person some of the so-called culture, but try to guide him and help him prepare for a vocation.

The High Schools have recognized in a small way the need of vocational education in the development of commercial courses, but these commercial courses have been in one or two specific fields and in some cases only gestures to an already glutted market. Teachers should have first hand knowledge of what is called for in industrial and commercial fields.

If I may say so without criticism, education, it seems to me, has worked always in this country—I am speaking now of public education—in close, perhaps too close, cooperation with government. But business and private industry have not taken the personal interest in education that it deserves.

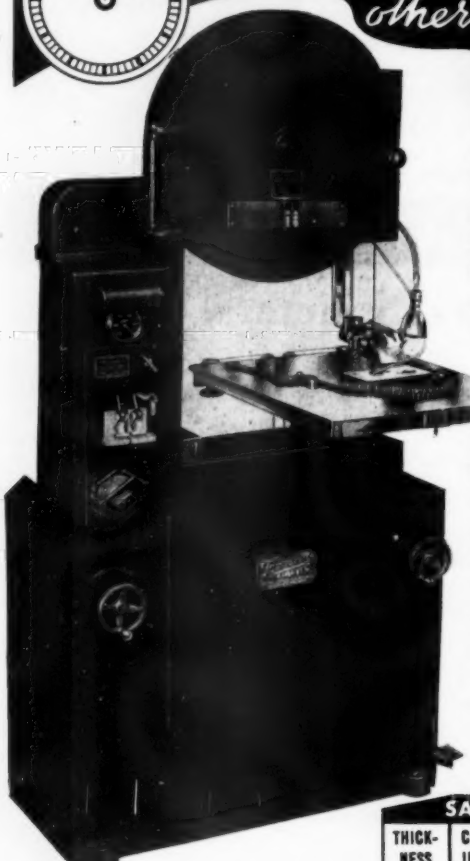
Vocational education has been the ugly duckling of education, and yet vocational education not only is essential to the economic welfare of thousands of young men and women, but it also is, or should be, the reservoir to which business and industry look for competent employees.

The business men of this country never had a better oppotunity to show what they stand for in their respective communities. My total administrative expenses for two years has been less than a thousand dollars. You will get a return from your efforts that will pay you many times. Help these men into a job and you will open up a new life for those who have missed a vocation. All they want is a chance to learn. The boys in our schools will tell you this is the first time that they have felt that they have ever had anyone take a sincere interest in them. It is one of the greatest contributions we can make to national defense and to the perpetuation of the American way of life. Help them learn the truth and knock out some of the ideas politicians have capitalized on for so many years. Show them that success has to be worked for, teach them to be production-conscious instead of to lean on shovels. Teach them that work built America, made it great, that work will protect their liberty as nothing else will, that the minute they accept their relief check, as just as good as a pay check, they surrender their rights.

They say there are no frontiers in this country; there is a frontier ahead, a frontier that only private initiative can open up as it has opened all frontiers. It is the frontier of the mind. We Americans can't fight our way this time with axe or gun. We have to think our way out and thinking has become a government function. Thinking should be a matter of private initiative, personal initiative, which starts with its roots right down in the community. This kind of thinking is the best guarantee of personal freedom.

TANNEWITZ DI-SAWS

Do in MINUTES jobs which otherwise require HOURS!



Conservatively estimated TANNEWITZ DI-SAWS save an average of 70% of the time and cost involved in making inside and outside cuts on dies, shoes, templates and the hundreds of other operations, including filing and polishing, to which these machines are ideally adaptable. In many instances they are turning out work in as little as ONE-TENTH of the former time required.

To expedite production and cut costs, by all means investigate the tremendous possibilities these machines offer in tool and die making and other applications.

	SAWING SPEEDS PER MINUTE				
THICKNESS	CAST IRON	COLD ROLLED	TOOL STEEL	HI SPEED STEEL	HI CHROME HI CARBON
¼"	16"	9"	5"	2⅜"	1½"
½"	8"	4½"	2½"	1⅛"	¾"
1"	3½"	2¼"	1¼"	½"	⅜"
1½"	2"	1"	⅝"	5/16	3/16"
3"	1"	½"	5/16"	5/32"	3/32"
6"	½"	¼"	5/32"	5/64"	1/32"

The popularity of DI-SAWING is growing by leaps and bounds. Get the complete facts on the most highly developed DI-SAW on the market. Simply write for our DI-SAW Bulletin.

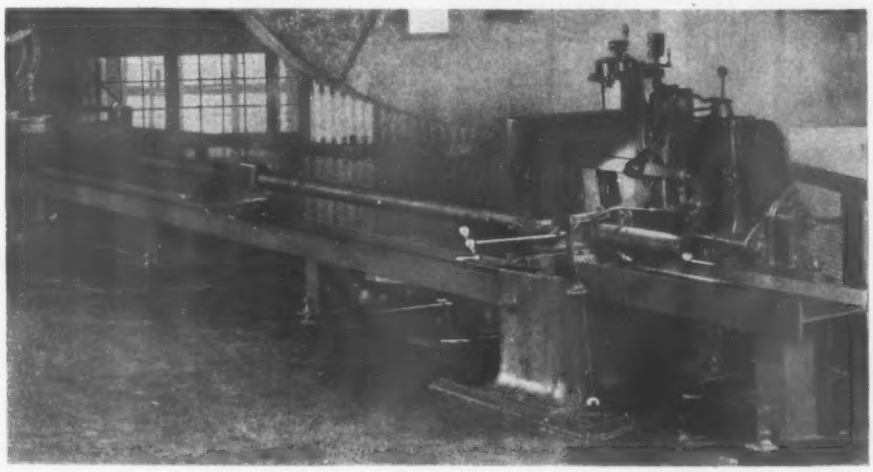
Made by Sawing Machinery Specialists

THE TANNEWITZ WORKS, GRAND RAPIDS, MICH.

Automatic Sawing is replacing other cutting-off methods

No other method of accurately cutting-off identical lengths or slices from bars or tubes can compete with a MARVEL Production Saw in speed or cutting cost.

The new MARVEL Production Saws will cut-off more identical pieces from bar stock per hour, and at a lower cost per piece, than any other method or machines. If you need real quantity production of accurately cut-off slices or lengths from single or nested bars, investigate these "Automatic" Sawing Machines.



- All-ball-bearing, heavy construction permits these saws to operate continuously, day after day at full capacity loads. Unbreakable MARVEL High-Speed-Edge Hack Saw Blades permit speeds and feed pressures far beyond those considered safe with ordinary blades.

- Available in two sizes: MARVEL 6A, Capacity 6" x 6"; MARVEL 9A, Capacity 10" x 10".

- Require no more operator attention than an automatic screw machine. Equipped with automatic bar push-up, these saws feed, measure, cut-off and stop after cutting any predetermined number of pieces.

Buy from your local distributor

MARVEL SAWS

ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People"
5700 Bloomingdale Ave., Chicago, U.S.A.
Eastern Sales Offices:
199 Lafayette St., New York, N. Y.

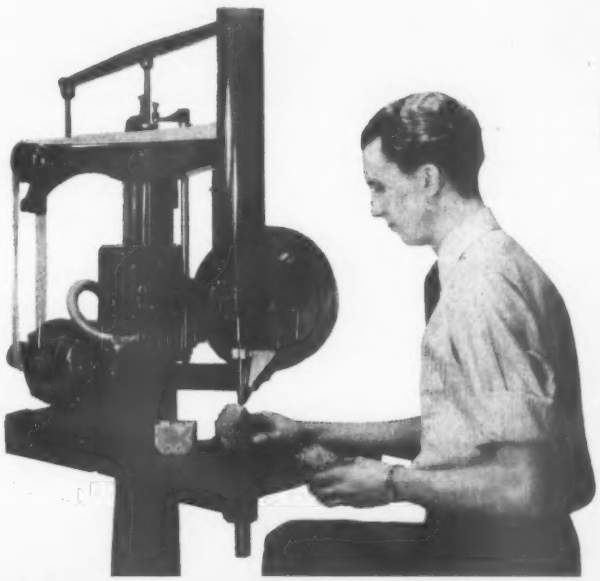
MODERN SCREWDRIVING EQUIPMENT THAT *CUTS* ASSEMBLY *COSTS*

NO LIMITATIONS

MACHINE SCREWS
WOOD SCREWS
SELF TAPPING SCREWS
CAP SCREWS
DRIVE SCREWS
SPECIAL SCREWS

STANDARD HEADS
SPECIAL HEADS
SLOTLESS HEADS
HEX HEADS
SQUARE HEADS
PHILLIPS HEADS

SEND SAMPLES for PRODUCTION ESTIMATES



HERE'S HOW

NO MARRING OF HEADS
NO TWISTING OFF HEADS
NO HANDLING OF SCREWS
NO STRIPPING OF THREADS
NO PRODUCTION BOTTLENECK

UNIFORM TENSION OF SCREWDRIVING ELIMINATES INSPECTION

THREE MODELS TO MEET ALL REQUIREMENTS

DETROIT POWER SCREWDRIVER COMPANY
5373 ROHNS AVENUE **DETROIT, MICH.**

NOW HE CAN DO A WIDER RANGE OF PRECISION TOOLROOM GRINDING

● Lou has been a toolmaker for over 29 years, and he knows the difficulties of turning out a precision grinding job worthy of his craft on the old time universal grinders. Now, with a new CINCINNATI Hydraulic Universal, he can do a wider range of jobs in less time, while holding closer limits of accuracy and finish.

At the time the picture was taken, Lou was grinding a taper of 3½" per foot on an attachment driving gear. That's a steep taper, but all sizes of CINCINNATI Hydraulic Universals can handle it. Among other features of versatility may be listed the Hinged Internal Grinding Attachment. It can be set up in less time than it takes to talk about it—merely swing it down, tighten in place with one hinged bolt, and it's ready to go. Tarry at each end of the table traverse may be independently adjusted. Automatic reversal with pick feed engaged may be set as short as 3/32", producing an automatic plunge cut effect.

CINCINNATI

Other features that develop *better grinding in your toolroom* are described in a booklet bearing that title, G-455. Write for your copy today.

CINCINNATI GRINDERS INCORPORATED

CENTERTYPE GRINDING MACHINES . . . CENTERLESS GRINDING MACHINES . . . CENTERLESS LAPPING MACHINES

Production Perspectives

News of Mass Manufacturing Everywhere

THE Glenn L. Martin Co., Baltimore, Md., announced Feb. 25 signing of government contract by which the company will operate the proposed federally-owned airplane assembly plant at Omaha, Neb., utilizing parts and sub-assemblies furnished by the automotive industry. The Martin company is the oldest aircraft manufacturing concern in continuous service in the United States and with expansion plans now under way, President Glenn L. Martin said, it is "about to become the largest." Three main plants, two at Baltimore, one at Omaha, together with airport and leased properties, will cover 5,192,725 square feet of space. Employment at Baltimore will be increased from 17,000 to 42,000. Employment at Omaha will depend upon the amount of sub-contracting done. Large additions to the main plant are now nearing completion. Structural steel is now going up on the new plant at Baltimore. Construction also is well along on a new Navy assembly building. Glenn L. Martin Co. preliminary report for 1940 shows profits of $4,306,489, on sales of $30,663,337. This compares with sales of $24,169,468 in 1939. January, 1941, sales, Martin said, were $6,228,364. Backlog now is $350,000,000 and with letters of intention $482,000,000.

Richard W. Millar, president of Vultee Aircraft, Inc., said March 4 at Los Angeles that the aircraft industry, in its present rapid expansion accompanying the defense program, was well on the way to mass production. "We now are, for the first time," he told stockholders in the company's first annual report, "approaching quantity production in the sense that the term applied to the automobile industry of many years ago." In 1940, said Millar, the industry more than doubled its shop area to 25,000,000 square feet and trebled its employment to 180,000 shop workers. Before the end of this year, he predicted, the shops will occupy 45,000,000 square feet and employ 283,000 workers. As for Vultee itself, he said that next month an expansion program from 146,300 square feet to 1,795,000 will have been completed in less than a year and a half. The Company will be employing 17,000 persons later this year compared with 850 on Dec. 1, 1939. The company's present back log of orders is $94,000,000.

THE government has become by far the biggest customer of business and the administration is not only increasing its orders for munitions and ships for our army and navy, but undertaking to procure the same for Great Britain and other nations, states the monthly business bulletin of the Cleveland Trust Co., large Cleveland bank. The nation is rapidly swinging over to a wartime economy, states the bank's review, which is followed internationally by industrialists and business men each month. It reports that sinkings by submarines have caused well over a third of all merchant shipping losses since the conflict began in September, 1939. Total losses from war in the 17 months through January reached 5,714,000 gross tons, according to Navy Department figures. "Subs" had accounted for 2,060,000 tons. For the next few months changes in the volume of production will be upward, but in a minor degree, the bank's review predicted, until results of much new factory capacity are felt. There then will be a series of new upward surges in output and in consumer purchasing power. The bank noted that "workers making durable goods are once more about 50 per cent of all factory workers, and this development constitutes one of the important symptoms of full industrial recovery."

Alfred P. Sloan, Jr., chairman of General Motors Corp., on March 17 advocated restrictions on consumer spending to permit peak production of defense materials and to prevent a situation which might touch off a post-emergency "disastrous" inflation. The urgency of Sloan's statement was accentuated by the fact that General Motors is one of the Nation's biggest producers of consumer goods and, therefore, might bear the full adverse near term impact of any curb on consumer spending. General Motors, it was recently disclosed, has approximately $683,400,000 of Government defense orders on its books but automobile authorities claim that profits on Government business will be negligible. Last year the corporation had record world sales of $1,794,936,642, a gain of 30 per cent over 1939. Thus, military orders now on the company's books are equivalent to only around one-third of the corporation's total sales for last year, indicating that its

P R I Z E W I N N I N G E X H I B I T

"I told you she'd be a 'bottleneck'!"

Your BEST INSURANCE Against

Speed-killing "Doubtful" Screws

Guarantee
OF HIGHEST QUALITY
To assure satisfactory performance, Parker-Kalon Fastening Devices are made to exacting specifications covering dimensional and physical characteristics which are checked at every stage of manufacture, and passed upon by Parker-Kalon's Quality Control Laboratory. Should this product prove faulty in any way, replacement will be made without charge.
PARKER-KALON CORPORATION
NEW YORK, N. Y., U. S. A.

A Guarantee that's backed by Parker-Kalon's Unique Quality-Control!

Only a handful of "doubtful" screws may lower the quality of a full day's output of a product. Besides, consider how screws which fail to function properly can slow up production and bring up costs.

That's why Parker-Kalon's Guarantee against "doubtful" screws – *screws that look all right but of which a percentage fail to make satisfactory fastenings* – is vitally important to you. This Guarantee is your assurance that the Parker-Kalon Screws you use have met the rigid tests imposed by the Parker-Kalon Quality-Control Laboratory. From raw material through the various processes of manufacture, inspections and tests guard against "doubtful" screws.

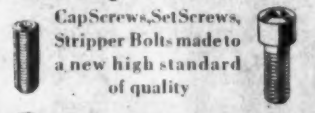
Specify Parker-Kalon and get Fastening Devices you can depend on to live up to the performance promises made for them. Parker-Kalon Corporation, 190-198 Varick St., New York, N. Y.

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

COSTS NO MORE *to get this Parker-Kalon Quality-Control Guarantee with every box of ....*

Hardened Self-tapping Screws
Types, sizes, head-styles for every assembly of metal or plastics

Cold-forged Socket Screws
Cap Screws, Set Screws, Stripper Bolts made to a new high standard of quality



Wing Nuts-Cap Nuts-Thumb Screws
Cold-forged . . Neater, Stronger

Quality-Controlled **PARKER-KALON Fastening Devices**

1941 net profits necessarily must depend in largest part on its private consumer business.

Director General William S. Knudsen of the office of Production Management said March 17 at Washington that there soon will be more than a 60 per cent increase in the number of man-hours of labor devoted to defense production. Urging labor and industry to cooperate in a training-in-the-shop program to increase the supply of skilled labor, Knudsen estimated the present labor level is at the rate of 18 billion man-hours annually. "The increase which will follow I haven't got the exact figures on, but it will be more than 60 per cent on top of that," Knudsen said.

Increased defense spending by the Government has pushed industrial activity to the highest level in history, the monthly Federal Reserve bulletin reported at Washington on March 13. Spending for defense is about four times greater than it was last spring, the board said; in February the Government spent $590,000,000 for defense, compared with a monthly total of $150,000,000 less than a year ago. Treasury officials have estimated that defense spending in June will be $1,200,000,000, which, if continued, would mean a yearly rate of $14,000,000,000 or about twice the present rate. The record-breaking industrial advance began at a rapid pace about the time Germany invaded the Low Countries last May, the Federal Reserve said, and the upward swing of business conditions has continued. "The present situation is markedly different from that a year ago," the report said. "Now the major questions are those concerning the extension of capacity in many lines and the provision of further growth.

THE idea of pooling industrial facilities to speed defense production, which is now being sponsored on a nation-wide scale by the National Association of Manufacturers, is by no means new in the greater Springfield, (Mass.) area.

The United States Armory, the largest defense establishment in the area, farms out work to several small industries. So does Van Norman, American Bosch, Gilbert & Barker, Chapman Valve, Baush Machine Tool and other industries engaged in defense work.

Roe S. Clark, treasurer of the Package Machinery Company and president of the Employers' Association of Western Massachusetts reported that the practice of pooling productive facilities has been going on for several years and that it has worked especially well under the defense program. "We're away ahead of many sections of the country in that sort of thing," he said, "even though it's done on an informal basis."

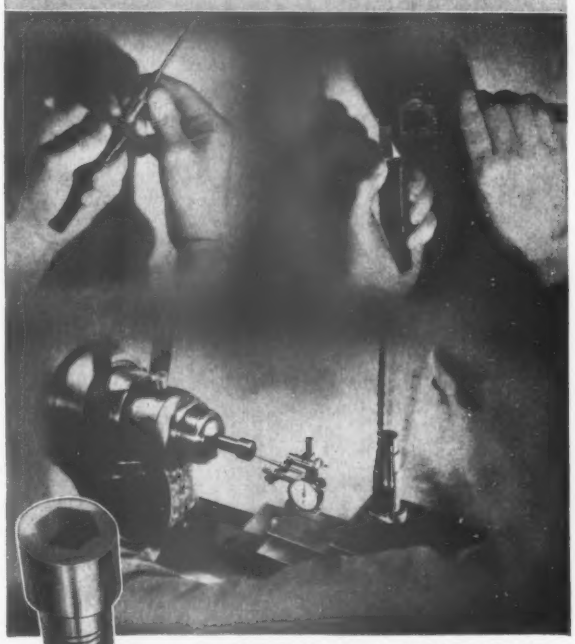
The American Bosch Corporation of Springfield, Mass. has been assured of a $748,000 government loan to help finance the cost of opening a branch factory in Providence, R. I. for the manufacture of Diesel fuel injection equipment for the United States navy. C. C. Francis, treasurer of the corporation says every effort is being made to speed the opening of the new plant which will give American Bosch about 53,000 extra square feet of manufacturing space and eventually will give employment to about 500 persons.

The Wico Electric Company, West Springfield, Mass. manufacturers of magnetos will shortly start work on a new modern plant of the monitor type costing approximately $40,000 to be located south of its present building. The new building will be 100 x 120. Provision is made for expansion.

The Savage Arms Company of Utica, N. Y. has taken title to the Westinghouse Company's 3½ acre plant in Chicopee Falls, Mass., idle for the past two years. The plant consists of seven buildings containing approximately 160,000 sq. ft.

The Defense Commission has announced certificates of necessity have been granted to the Perkins Machine and Gear Co. of West Springfield, for a $359,000 plant expansion, Stacy Machine Company, Springfield, $44,000 and Springfield Bronze and Aluminum Company, Springfield, $15,000.

"Doubtful" Socket Screws
"BLACKBALLED"!



3 of 16 Precision Steps in QUALITY-CONTROL

16-Point Quality-Control Guarantees Every Parker-Kalon Socket Screw

Most socket screws are good socket screws. But it takes only a few poor ones in a lot to cause trouble. That's why it pays to specify Parker-Kalon!

For Parker-Kalon gives you complete protection against "doubtful" screws—screws that *look* all right but of which a percentage fail in use – resulting in assembly delays and service complaints. In Parker-Kalon's QUALITY-CONTROL Laboratory – finest in the industry – an exacting 16-point inspection routine assures unvarying uniformity of physical and metallurgical characteristics . . . *eliminates "doubtful" screws.*

You can get this extra protection at no extra cost! Specify PARKER-KALON! Parker-Kalon Corporation, 190-198 Varick Street, New York.

Quality-Controlled

16-point test and inspection routine covers: Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Tension and Shear; Hardness; Head diameter, height and concentricity; Socket shape, size, depth and centricality; Class 3 Fit Threads; Clean-starting Threads.

PARKER-KALON
COLD-FORGED
Socket Screws

HERE'S THE MACHINE THAT AMAZED ENGINEERS AT THE "TOOL SHOW"

It's built to keep on paying profits on jobs like these in any plant

CARPENTER SHOP

One DeWalt does the work and earns the profits of many machines. It expertly handles all kinds of maintenance work.

PATTERN SHOP

The most complicated patterns you have are no problem to the DeWalt. It makes every cut desired with the accuracy expected.

CRATING SHOP

DeWalt is the fastest machine you can get for straight cut-off and rip in building standard or special crates, cases, boxes, etc.

PRODUCTION LINE

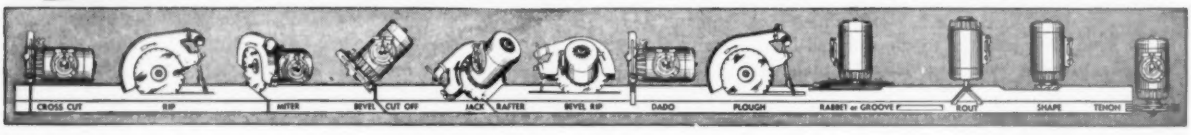
DeWalt is engineered and built to handle peak volumes on any operation. It's a dependable machine on any production line.

Free BOOKLET

WIRE, WRITE OR PHONE . . .

DEWALT PRODUCTS CORPORATION
704 Fountain Avenue, Lancaster, Pa., U.S.A.

ONE DEWALT GIVES YOU ANY CUT YOU WANT — WHEN YOU WANT IT!



IT'S NEW

NEW EQUIPMENT – NEW MATERIALS – NEW PROCESSES

NIAGARA (E17) POWER SQUARING SHEAR

A new Power Squaring Shear having 18 foot cutting length and capacity of 3/16 inch is announced by Niagara Machine & Tool Works, Buffalo, New York. The shear is equipped with a quick setting, self-measuring, ball-bearing, parallel back gage adjustable to increments of 1/128 inch. All drive gears are mounted on anti-friction bearings, and enclosed in oil-tight case. The shear is controlled by means of a 14 point clutch which operates in a bath of oil.

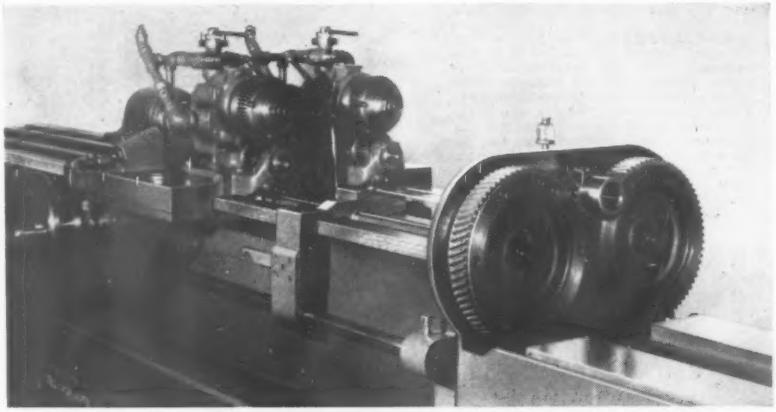
The shear can be equipped with fluorescent lights which perform the dual function of illuminating the working surface of the bed, and throwing a shadow line at the cutting line for convenience in shearing to a straight edge. Toggle operated, independent spring pressure foot hold-down provides a smooth and firm grip on sheets of varying lengths.

Niagara Power Squaring Shear
Equipped with fluorescent lights to throw a shadow at the cutting line.

PRATT & WHITNEY (E18) DEEP HOLE DRILLER

The new design of the Pratt & Whitney No. 1½ Deep Hole Driller is said to be built to handle a wide range of work requiring long true holes up to 2" diameter. This includes gun barrels, connecting rods, hollow spindles, bridge pins, boring bars, printing press rolls, and crank and cam shafts. Designed to meet modern production requirements, the single flute, deep hole drill used remains stationary, while the work revolves around it. This drill consists of a high speed steel tip on a long tubular steel shank so arranged that oil under high pressure is led through the tube and through a hole the length of the tip to the cutting lip. Oil blows chips away from the cutting edge as fast as they form, and carries them out to the pan through a flute running along the outside of the tip and the tube.

This driller is a twin unit—designed to drill two pieces simultaneously. The operator can reload and start one spindle while the other is drilling. Separate motors mounted on top of the head-stock drive the work spindles through gears, and also supply power for feeding the drills.



Pratt & Whitney Deep Hole Driller
This twin unit drills with one spindle while the other is being reloaded.

WALKER-TURNER (E19) RADIAL DRILL

A new low-cost radial drill for performing light duty operations is announced by Walker-Turner Co., Inc., 4931 Berckman Street, Plainfield, New Jersey. The drill head is mounted on a heavy cast-iron ram which rides back and forth in a supporting cradle on eight precision ball bearings. The ram can be quickly locked in any desired position with a quarter turn of the clamp lock. The drill head, ram, and cradle swing easily right and left on a machined collar mounted on the top of the raising and lowering column. The drill head ram and cradle are raised and lowered by a crank-operated screw mechanism mounted on the side of the supporting column.

Capacity of the drill is said to be unusually large, drilling to the center of

PLEASE NOTE: The purpose of this department is to call to the attention of its readers new production ideas. To aid readers in getting complete technical data on any item in which they are interested a key number is given for use on the post card bound in this issue.

a 62" circle. Ram travel is 18". Added versatility is secured because the head can be tilted up to 45° either right or left.

FEDERAL GUN GAGE (E20)

New rifle and gun gage designed for checking the lands and grooves of gun barrels ranging from small pistols and rifles up to large sized artillery guns. is announced by Federal Products Corp., Providence, Rhode Island. The head of the gage consists of three sensitive contact points and three guide points. The entire head revolves, so that the guide points, as they move down the grooves, will rotate the head as the gage is inserted down the gun barrel. This allows the contact points to follow the grooves for diameter, out-of-roundness, and taper. The land of the gun barrel can also be checked in the same way. The guide points prevent the contact points from slipping off the land into the groove. At intermediate points, depending upon the length of the barrel, wooden supporting collars are used to keep the gage in alignment and yet free enough to float.

Federal Gun Gage
Contact points follow either grooves or lands.

The barrel of the gage itself is graduated in inches so that the inspector can determine how far in he is checking at any time. Contact points are contracted by simply pulling on the trigger beneath the dial indicator.

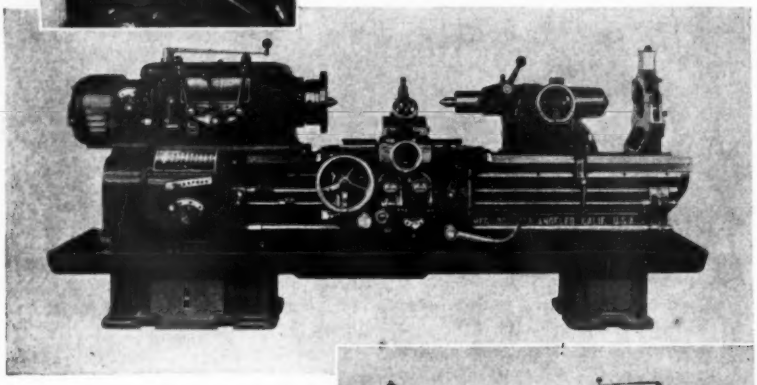
CUNNINGHAM FLOATING TYPE BRANDER (E21)

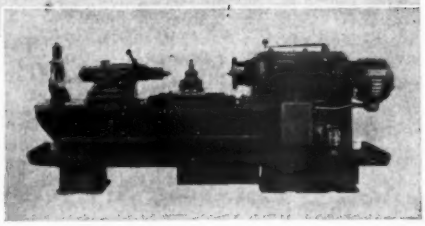
A new floating type roll brander offered by M. E. Cunningham Company. 169 E. Carson Street, Pittsburgh, Pa., is said to reduce the time of marking mill rolls to between 15 to 30 minutes where previous methods required 6 to 8 hours. Both the roll and holder are of one-piece construction to eliminate any possibility of thread or screw failures. The unique floating feature allows each piece of type to level itself in the roll and there is said to be no chance of it being wedged in an off position. This results in a clearer branding with every character the same depth. This same floating type feature eliminates type breakage because the pressure is always on the center line.

Cunningham Roll Brander
The type does not wedge.

You'll like the clean, compact design of an

AXELSON LATHE





Illustrated above center is the front view of a 20" Axelson Heavy Duty Lathe, while just below it is shown the rear view of the same lathe.

Axelson Lathes are built like you always wanted a lathe to be built,—like you've said you would build a lathe if you were in that business. They're not dolled up with a lot of fancy gadgets. Front and back, they're the height of simplicity, with each control, each operating part within instant reach. The best of design, materials and workmanship have been combined by Axelson in producing a lathe unexcelled in operation.

DISTRIBUTORS: The Brown Tool Company, Cleveland — Griffin & Ross Machinery Co., Los Angeles — G. H. Lynn, Direct Factory Representative, Washington, D. C. — Albert Hepworth, Philadelphia — B. C. MacDonald & Co., St. Louis — McArdle Equipment Co., Houston — Osborne Machinery Co., San Francisco — Edward W. Voss, Dormont, Pittsburgh — Wilson & Brown, Inc., New York City — Winterhoff Machinery Co., Detroit — H. F. Wolnick Machinery Co., Chicago — Earl E. Wright, Chattanooga.

AXELSON MANUFACTURING COMPANY

6160 South Boyle Avenue, Los Angeles, California (P. O. Box 98, Vernon Station)
50 Church St., New York • 3844 Walsh St., St. Louis

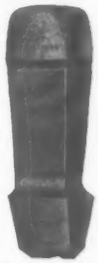
WRITE TODAY for your copies of these brand new Axelson circulars.

Heavy Bevel Letters & Figures

SPEED UP DEFENSE WORK AND CUT YOUR COSTS with SAFETY Steel Stamps and Holders

SAFETY HEAVY BEVEL LETTERS AND FIGURES—for those operations which cannot use a multiple character holder outfit. Heavy Bevel Stamps will give an outstanding performance on any type of marking and is recommended especially for airplane and other defense industries which require marking of high alloy steels and other alloy metals. Safety Steel construction eliminates spalling and mushrooming of both head and character end. Write for samples.

SAFETY WEDGE GRIP SYMBOL STAMPS—for piece work identification, inspector's marking, and also for stock room and assembly records. We can furnish Wedge Grip Symbol Stamps with any of 500 different symbols, from 1/8" to 1/2" size. Safety Wedge design shank will give the maximum in service and safety because they will not spall or mushroom or slip out of the operator's hand. Write for complete list of symbols.



Wedge Grip Symbol Stamps

SAFETY BOX TYPE HOLDER—for hot or cold stamping on castings, billets, axles, and other operations previously requiring sledge or hand model holders. Box Holder can be leveled on piece being marked to give a clearer and deeper impression. SAFETY STEEL construction prevents spalling and mushrooming. Outside box acts as a guard by keeping scale and broken pieces of type from flying. Can be made for any size or number of characters.

Box Type Holder

Partial List of Symbols

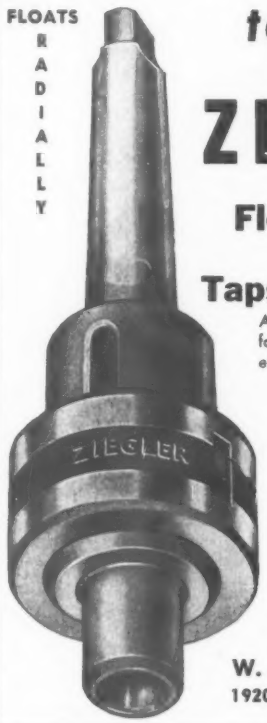
Write for information on our 30 DAY TRIAL offer.

M. E. CUNNINGHAM CO.

169 E. CARSON ST.
PITTSBURGH, PA.

Having difficulty holding tolerances?

FLOATS RADIALLY



DEMAND THE

ZIEGLER

ROLLER DRIVE

Floating Holder

for

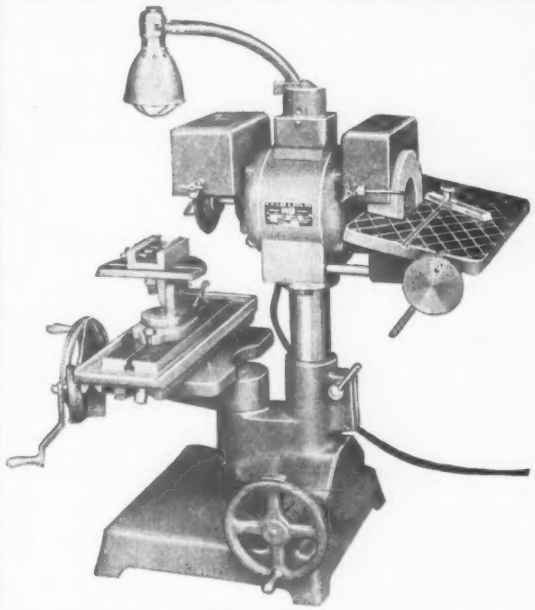
Taps and Reamers

AUTOMATICALLY compensates for machine spindle misalignment, eliminating over-sized or bell-mouthed holes.

Helps produce unbelievable accuracy on both new and old equipment.

Furnished with male or female taper, straight, threaded or special shanks to fit any machine used for tapping or reaming.

W. M. ZIEGLER TOOL CO.
1920 Twelfth Street DETROIT



This ***NEW CARBIDE TOOL GRINDER*** performs all of the necessary operations for the upkeep of high speed carbide-tipped tools.

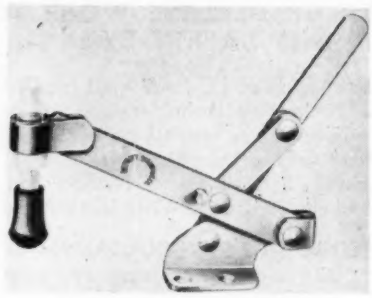
Bulletin CTG40-TE4 tells all about it.

K. O. LEE COMPANY

Aberdeen, South Dakota, U. S. A.

DETROIT STAMPING (E-22) AIRCRAFT TOGGLE CLAMP

A new, patented, low price, small, light weight model toggle clamp for aircraft work is announced by the Detroit Stamping Company, 356 Midland Avenue, Detroit, Michigan. Because of its reduced size, 6" x 6" x 1⅛" overall, this clamp is said to be especially suited for production work in the aircraft industry. It has a clamping ratio of 33 to 1 and is intended for holding parts during welding, drilling, machining, assembly, and other aircraft production operations. The clamp is made of cold drawn, tough steel, is bright cadmium plated and weighs 9¼ ounces. The manufacturer states that the parts of this clamp are finely machined to assure free working, yet design is such as to avoid looseness at bearing points.



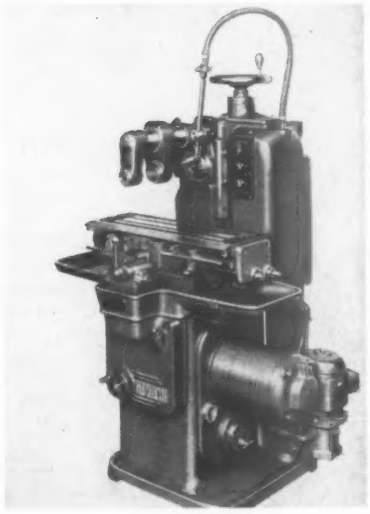
Aircraft Toggle Clamp
Clamping ratio of 33 to 1.

SUNDSTRAND (E23) HYDRAULIC RIGIDMIL

A new and smaller Rigidmil is announced by the Sundstrand Machine Tool Co., 2532 Eleventh Street, Rockford, Illinois. It is available with either power feed or hand feed.

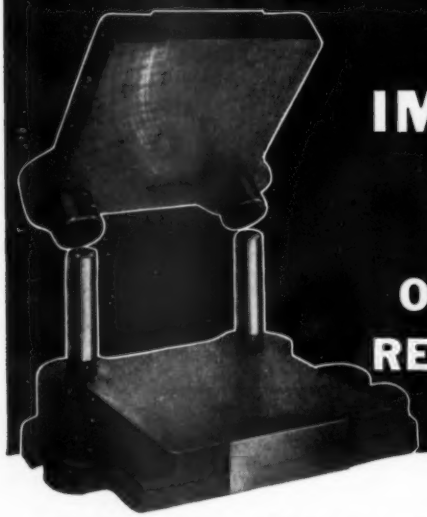
The power feed machine illustrated has a hydraulically actuated table, with a wide range of automatically controlled table cycles including two way cycles and skip feed. Climb or conventional milling can be done either separately or in combination.

The table has a maximum stroke of 8" and a rapid traverse rate of 400" per minute. Feed and rapid traverse strokes can be regulated within maximum limit to suit requirements of the job. Two feed ranges are available, one from ½" to 37" per minute, and the other from 1¼" to 66" per minute. Any desired feed rate within the range of the machine can be secured by adjustment of the feed selector dial which furnishes a direct dial reading in inches per minute. A wide range of spindle speeds are possible. The ratio between the high and low speeds is 42½ to 1 which is said to make possible the machining of practically all types of materials without sacrifice in production or finish because of lack of speed range.



Hydraulic Rigidmil
Climb or conventional milling.

The Interchangeability of DANLY DIE SETS IS IMPORTANT TO YOU *In the* OCCASIONAL REPLACEMENT OF A PART



It Is Far More Important As a Continuous Guarantee of Accuracy in Die Making and Daily Production of Stampings

WRITE OR CALL YOUR DANLY BRANCH

DANLY MACHINE SPECIALTIES, INC.
2112 So. 52nd Ave., Chicago, Ill.

513 East Buffalo Street, Milwaukee, Wis.
36-12 34th Street, Long Island City, N. Y.
990 E. Monument Avenue, Dayton, Ohio
1549 Temple Avenue, Detroit, Michigan
16 Commercial Street Rochester, N. Y.
1745 Rockwell Avenue, Cleveland, Ohio
3913 North Broad Street, Philadelphia, Penna.
Ducommun Metals & Supply Company, Los Angeles, California; San Francisco, California

DANLY DIE SETS and DIE MAKERS' SUPPLIES

● Procunier High Speed Tapping heads are producing more and better work in Thousands of plants today! Here is a close-up photograph of one of these efficient tapping heads in action in an automotive plant speedily producing accurate threads in axle sleeves for U. S. Army Trucks. Procunier Tapping Heads are compact and accurate, featuring—dry, double cone friction clutch which is designed not to wear and which won't absorb oil—easy bottom-tapping—three point, balanced, heat treated gear reversing mechanism—even distribution of pull and the elimination of undue strains—great reduction in tap breakage. The need for using extension taps is entirely eliminated. Procunier Tapping Heads and Universal Tapping Machines are ready for prompt deliveries.

Send for Bulletin

giving full details, description and prices on complete line of Procunier Precision Tapping Heads to meet all needs, the new Tru-Grip Tap Holder—and also the full line of Procunier Universal Machines, hand, foot or air-operated.

PROCUNIER Safety Chuck Co.

12-18 S. CLINTON ST. CHICAGO, ILL.

Procunier Safety Chuck Co.
12-18 S. Clinton St., Chicago

Send me bulletins on: ☐ High Speed Tapping Heads ☐ Tru-Grip Tap Holders ☐ Universal Tapping Machines.

Name.....

Address.....

GAMMONS OF *Manchester*

PRODUCTION TOOLS

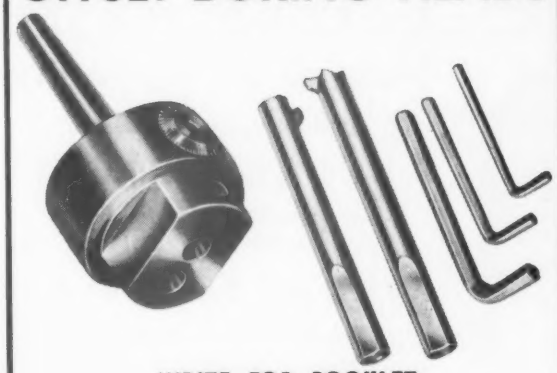
ORIGINATORS AND
MANUFACTURERS OF HELICAL
FLUTED TAPER PIN REAMERS

THE GAMMONS-HOLMAN CO., MANCHESTER, CONNECTICUT

FRAY

MICROMETER

OFFSET BORING HEADS



WRITE FOR BOOKLET

FRAY

MACHINE TOOL CO.

Makers of

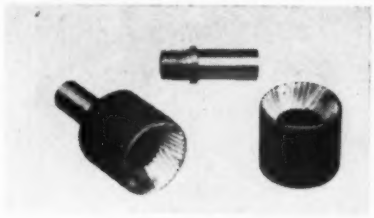
"ALL ANGLE"

MILLING MACHINE &
MILLING ATTACHMENTS

505 W. Windsor Road Glendale, California

SEVERANCE (E24) DEBURRING CUTTER

A new cutting tool for deburring ends of rods and tubing, formerly supplied on special order, has been added to the line of Severance standard tools offered by the Severance Tool Mfg. Co., 1522 E. Genessee Avenue, Saginaw, Michigan. This cutter should be of assistance in the removal of rough edges or burrs by producing a slight chamfer and, also in the removal of flash or similar conditions from the edges of bosses, collars, and bushings of cast, forged, and molded parts. The tool has a standard mouth angle which produces a chamfer of either 30 or 45 degrees as required.



Deburring Cutter
Now part of the standard line.

The remarkable chamfer cutting action of this tool is said to be due to the Severance tooth design which produces a shearing cut that forces the chips out or from the tool, thus preventing loading.

HYBCO (E25) TAP GRINDER

A new model Hybco Tap Grinder for sharpening taps on the chamfer, flutes, and special points is announced by H. P. Boggis & Co., Cleveland, Ohio. This grinder has a capacity for sharpening taps in sizes from No. 2 Machine Screw to 5/8" hand taps and No. 4 Machine Screw to 1" hand taps. They will also grind taps with two, three, or four flutes.

Taps are held in precision collets and are easily located by setting finger. The head can be swiveled to produce any chamfer angle. Each revolution grinds all lands in rotation. Both slides have graduated feed screws for accurate setting.

MODERN (E26) COLLAPSIBLE TAP

Bottom hole tapping with standard chasers is one of the features of the new line of Collapsible Taps recently announced by Modern Tool Works, Rochester, New York. This new Modern Collapsible Tap is made with a one piece body which has a solid end. By this construction there is no end plate or cap required and regular chasers extend beyond the tap body permitting close to bottom tapping.

This design is also said to add to the rigidity and strength of the tap as chaser slots cannot spread and chasers are securely and accurately held in position. Collapsing is positive and always at the same point, being effected by an adjustable hardened steel trip plate coming in contact with the work which causes the chasers to collapse quickly leaving the threads clean and unmutilated.

Collapsible Tap
No end plate or cap required.

RIVETING THROATS
from 6 to 45 inches
in the New Complete Line of
CHICAGO RIVET'S
Automatic Riveting Machines
Designed Especially for
AIRCRAFT RIVETS
PROMPT DELIVERY
A SPECIAL BROCHURE
illustrating and describing 4 models of Chicago Rivet's new aircraft automatic rivet setters sent upon request to any interested executive.
TUBULAR AND SPLIT RIVETS • AIRCRAFT RIVETS
Chicago RIVET & MACHINE CO.
1853 South 54th Ave. (Cicero P. O.) Chicago, Illinois
AUTOMATIC AND MANUAL RIVET SETTERS FOR 1 TO 4 RIVETS AT A STROKE

WHY DO YOU STOCK EXTRA TOOLS?

Because when you want tools, you want them in a hurry—at a moment's notice. That is why tools should be stored in "ROTABINS"—Rotating Steel Storage Equipment.

"ROTABIN" stores all binable items in a compact space below eye-level, easily accessible, with systematic stock arrangements.

"ROTABIN" eliminates time loss and confusion in filling orders.

SEND THIS COUPON TODAY

Gentlemen: Please send me NEW ROTABIN catalogue.

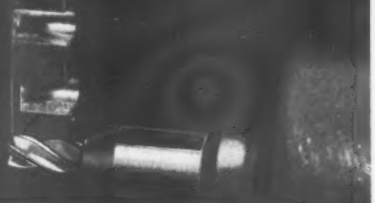
NAME_____

COMPANY_____

CITY_____ STATE_____

THE FRICK-GALLAGHER MFG. CO. • WELLSTON, OHIO

MORE SPEED LONGER LIFE with PUTNAM END MILLS



In an operation such as that illustrated —milling 3/8" slots in a die block— Putnam End Mills permit the maximum speed and feed. In addition, manufacturing and heat treating methods assure long, trouble-free service. Why not prove to your own satisfaction—by actual use on your machines—that the end mills which do "cut faster and last longer" are produced by Putnam?

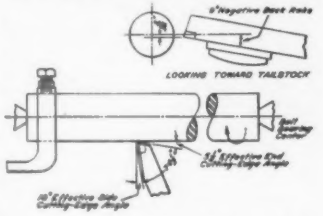
PUTNAM TOOL COMPANY

2987 Charlevoix Ave. • Detroit, Michigan

KENNAMETAL

"TIPS" FOR MACHINISTS

HOW TO OVERCOME CHATTER IN TURNING SLENDER SHAFTS



In the illustration at right, a left hand KENNAMETAL-tipped tool has been placed upside down in the tool-post and the lathe run backwards. Used in turning a 0.35 carbon steel shaft, 1 7/8" diam. and 49 1/2" long, this tool set-up eliminated the chatter which steadyrests had not overcome. The same set-up might well be applied on other jobs where long slender work must be turned.

This is the first of a series of advertisements describing how to get the most effective use from carbide-tipped tools. We will welcome your suggestions—whether or not you use KENNAMETAL. Please enclose drawings whenever possible.

McKENNA METALS Co.

600 LLOYD AVENUE

LATROBE, PENNSYLVANIA, U.S.A.

NUSITE HARDENED TOOLS (E27)

A method of hardening high speed steel to 65-67 Rockwell C, known as Nusite, and said to have twice the toughness and strength of tools hardened by ordinary methods, is offered by Perfection Tool and Metal Heat Treating Co., Chicago, Illinois. Tools hardened by the Nusite process are said to fill the gap between ordinary high speed steels and carbides. It is claimed that they will remove more metal in less time, cut tougher steels or non-ferrous material, decrease breakage and chipping, and save grinding time.

MACHINERY MANUFACTURING NEW SHAPER (E28)

A precision Shaper with a rigid streamlined pedestal base has been developed by Machinery Manufacturing Co., 1915 51st Street, Vernon, Los Angeles, California. The base is designed to give foot room for the operator to work close without stubbing toes. A new feature is the addition of a hand wheel to change motor speeds. This wheel is located on the front of the pedestal; by turning it, an infinite change of motor speeds within the limits is permitted.

The structure is engineered to eliminate noise and dampen vibration; the motor and hanging base mountings are cast integrally with pedestal to assure perfect alignment. The Shaper has a maximum stroke of 11¼". The ram length is 21" and 50 to 150 strokes per minute are provided by variable speed. Floor space required for the entire assembly is 24" x 36".

Precision Shaper
Hand wheel to change motor speeds.

BRIGHTBOY DISCS AND POLISHING WHEELS (E29)

Discs and polishing wheels for removing small blemishes on finished steel, to be known as Brightboy, have been placed on the market by Weldon Roberts Rubber Company, 351 Sixth Avenue, Newark, New Jersey. Heat marks from welds are said to be quickly erased with Brightboy, leaving a bright clean surface.

Wherever small burrs, stains, or rust appear on metal work, Brightboy Discs and Polishing Wheels can be used. A soft rubber binder which cushions the abrasive is used, which is said to give a bright lustre finish without spoilage if the work should slip during the operation.

NEW A.S.T.E. CHAPTER PLANNED IN CANADA

Plans for the chartering of a second Canadian Chapter of the A.S.T.E., were announced recently. The chapter will be at Hamilton, Ontario.

The Hamilton Chapter will be No. 42 on the list of chapters, and will be the fourth new chapter within three months. The three just chartered are at Seattle, Springfield, Vermont, and New Haven, Conn.

Destroyer of Friction and Wear

GATCO

ROTARY DRILL and PILOT BUSHING

The bore is as perfect as the perfection of the incorporated precision ball bearing. It is

ROUND - CHATTERLESS - SMOOTH

is built for

Core Drilling
Turret tool piloting
Hollow mill piloting
Linereaming

Boring bar work
Spot facing
Carbide boring
Precision drilling

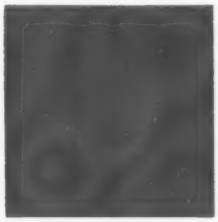
Dust proof as a watch

GIERN & ANHOLTT TOOL COMPANY

1312 MT. ELLIOTT AVE., DETROIT, MICH.

BUILDERS OF CARBIDE & DIAMOND BORING MACHINES AND EQUIPMENT

CAN A FLATTER SURFACE IMPROVE *Your* PRODUCT?



The straightness of these bands formed by interference of light waves reflected from the flat-lapped steel surface gives a true measure of its flatness.

Many people have parts, such as seals, which can be improved by greater accuracy of the lapped surface.

Acme lapping technique has been developed to make possible the finishing of parts in production to within five millionths of an inch (.000005") from absolute flatness. The cost is surprisingly low.

Our Engineering Department is available for advice on lapping problems. No obligation, of course.

May we consider *your* problem?

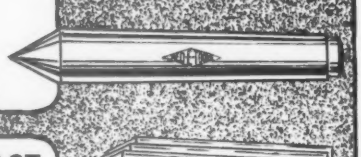
ACME INDUSTRIAL COMPANY

Makers of Standardized Jig and Fixture Bushings

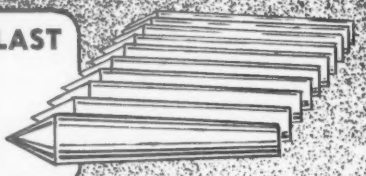
208 N. Laflin St. Chicago, Ill.

MONroe 4122

1
RED-E CENTER



WILL OUTLAST
10
CARBON CENTERS



Because RED-E centers have high speed steel ends, giving longer life at high speeds — increasing output and reducing time for grinding points.

Write for Catalog E 41

THE READY TOOL COMPANY

585 IRANISTAN AVE. BRIDGEPORT, CONN.

New Literature

Of Interest to the Tool Engineer

(167) Lathe Catalog
America Sings. 72 pp. The R. K. LeBlond Machine Tool Company, Cincinnati. This Catalog will meet a poor reception with those who believe that the presentation of statistics about machine tools must be dull and unattractive, for here is a catalog, built upon a theme drawn from Walt Whitman's Poem "I Hear America Singing," which carries a theme throughout and presents the specifications of the LeBlond line in attractive format and with text written for facile reading. With its concern with the National Defense Program, its nine airbrush murals, and its clear cut presentation of statistics, it is a milestone in the development of machine tool catalogs.

(168) Grinding Handbook
For "Grinder" Men Only. 24 pp. Koebel Diamond Tool Company, 9350 Grinnell Avenue, Detroit. An attractive handbook, amusingly illustrated, intended to help new workmen learn the rudiments of handling diamond tools. The company is also distributing a cardboard poster in the interest of careful handling of tools: "When any man adds a single hour to the production life of a tool, or makes that tool do better work, that man makes a worthwhile contribution to America's ideas and to America's future."

(169) Steel Folder
Ryerson V. D. Steel. 4 pp. Joseph T. Ryerson & Son, Inc., Chicago. This folder describes the application and characteristics of V. D. Steels for shear blades, dies, punches, chisels, cutters and taps.

(170) Tool Grinder
The Oliver Ace Universal Tool and Cutter Grinder. 12 pp. Oliver Instrument Company, 1440 East Maumee Street, Adrian, Michigan. This well illustrated bulletin shows many of the types of cutters which can be ground on this machine with standard fixtures, and gives some ideas of the possibilities of special fixtures, as well as complete specifications.

(171) Stainless Steel
Fabrication of Allegheny Stainless Steels. 28 pp. Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. A thorough analysis of methods of fabrication of stainless steel, including chapters on Welding, Drawing and Blanking, Machining, Spinning, Upsetting and Forging, Riveting, Shearing, Soldering and Brazing, Annealing and Heat Treatment, Grinding, Polishing and Buffing, and Surface Treatment.

THIS new 200-page MIDWEST Catalog No. 17 is the "CATALOG-OF-THE-YEAR". Just off the press, its precision metal cutting tools and engineering material will prove a real help in your metal cutting operations.

A FREE copy is available without charge to any responsible individual who sends his request on his company's letterhead. Don't delay—write today.

MIDWEST TOOL & MFG. CO.
2317 W. JEFFERSON DETROIT, MICH.

MIDWEST *Precision* METAL CUTTING TOOLS
END MILLS • SLEEVES • COUNTERBORES • DRILLS • SPECIAL TOOLS
REAMERS • MILLING CUTTERS • FORM TOOLS • CARBIDE TIPPED TOOLS • ADJUSTABLE HOLDERS

HOW TO ORDER

Booklets listed in these pages or information on new equipment may be obtained by using the post card bound in this issue. Merely fill out one coupon for each item desired, being sure to print plainly and to include position and company. Mail the card to us and you will receive the information desired at once.

(172) Live Centers
Ready Tool Catalog. 32 pp. The Ready Tool Company, 585 Iranistan Avenue, Bridgeport, Conn. A complete catalog, with prices, of the Red-E-Tools line, including ball bearing centers, high speed centers, tool holders, grinder dogs, and boring bars.

(173) Transmissions
Let in the Light with Western Transmissions. 4 pp. Western Manufacturing Company, 3406 Scotten Avenue, Detroit, Michigan. This folder features two models of transmissions for motorizing various Cone driven machine tools.

Send for Valuable Booklet

Forgings For All Industries
Rough Turned or Finished Complete

Composite Die Sections
Extrusion Tools
Crankshaft Forgings
Gear Forgings
Die Casting Dies

Rings, Discs, Blocks, Shafts, Hubs, Bars, and Special Shapes.
Tool Steel of all Makes
S.A.E. Specifications

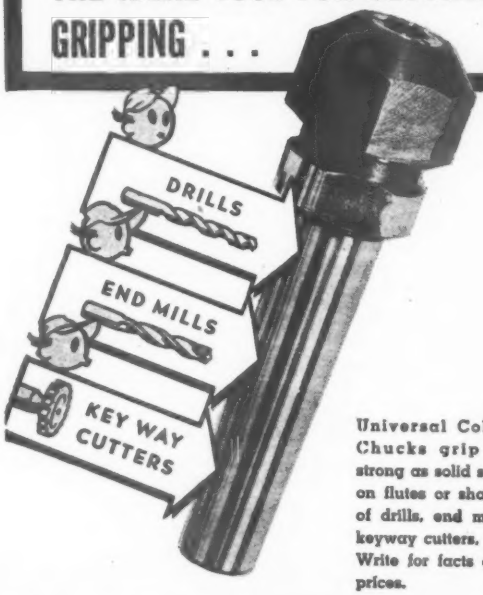
STAINLESS & COPPER FORGINGS

May We Serve You?

AJAX STEEL & FORGE Co.

205 ADAIR STREET **DETROIT, MICHIGAN**

THE IDEAL TOOL FOR SECURELY GRIPPING . . .



Universal Collet Chucks grip as strong as solid steel on flutes or shanks of drills, end mills, keyway cutters, etc. Write for facts and prices.

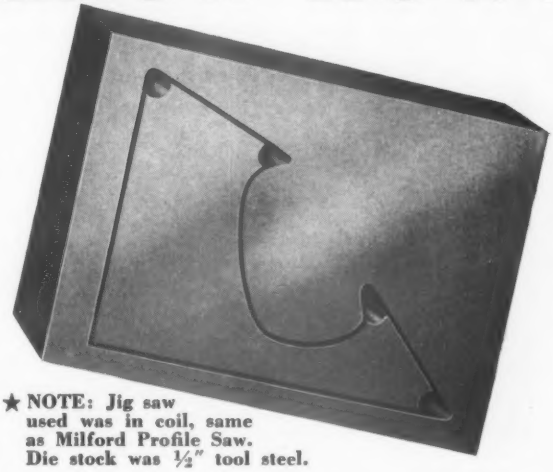
UNIVERSAL ENGINEERING CO.
FRANKENMUTH MICHIGAN

Back in 1896

MILFORD PROFILE SAW

cut this die... proof that

MILFORD *has the* KNOW-HOW!



★ **NOTE: Jig saw used was in coil, same as Milford Profile Saw. Die stock was ½" tool steel.**

New Haven, Conn., April 21, 1896.

The Henry G. Thompson & Son Co.

Gentlemen—It gives me pleasure to report the first trial of your jig saw on die work, viz: I had two blanking dies to make the same size, one right and one left hand. I gave one to my die-maker to drill, chip and file out, which took him six hours. I sawed out the other one on your jig saw; time, one and three-quarters hours.

Yours truly,

George M. Griswold.

A machine for profile-sawing is no better than its saw. Milford Profile Saw is the fastest-cutting, most durable saw made—by the world's largest, most experienced manufacturer of metal-cutting band saw... today as in 1896.

For years Milford Profile Saw has been sold largely under the private brands of machine manufacturers. Now you can obtain it from your Mill Supply Distributor. No delay.

★ **Write for free sample, giving specifications of saw you now use, and make of machine.**

THE HENRY G. THOMPSON & SON CO., NEW HAVEN, CONN.

MILFORD

REZISTOR HACKSAW BLADES - PROFILE SAW

and a mounting which accommodates all NEMA frames 204 to 326.

(174) Profile Grinders

Cost Reducing Tools for the Tool Room. 6 pp. Boyar-Schultz Corp., 2116 Walnut Street, Chicago. A folder containing in handy condensed form the greater part of the Boyar-Schultz line of tool room tools. Included are two profile grinders, grinding wheels, S M B bolts, and copper head laps.

(175) Cutter Grinding

Milling Cutter Grinding Manual. 20 pp. and charts. Carboloy Company, Inc., 11145 East 8-Mile Rd., Detroit. A shop manual on grinding practice in connection with cemented carbide type face mills and end-cutting tools, covering the selection of grinding wheel type, shape and speed, and recommending tooth profiles for different purposes and different forms of milling cutters and end-cutting tools.

(176) File Catalog

American Swiss Files of Precision. 32 pp. American Swiss File & Tool Company, Elizabeth, N. J. This catalog describes the origin of Swiss Pattern Files, explains how the files are manufactured, illustrates different cuts, and comparative cuts. It includes suggestions for the selection, use, and care of files, and includes more than three thousand different shapes, cuts and sizes of American Swiss files, with description, illustration of each shape, and explanations of their use.

(177) Duplicating

Low Cost Die and Mold Duplicating. 12 pp. Detroit Universal Duplicator Company, 215 St. Aubin Street, Detroit. This folder shows how the duplicator control can be used to control almost any machine tool and provide accurate duplicating, permitting the reproduction of original model directly in metal. Illustrated are applications with turret lathes, planers, shapers and millers.

IT'S NO TROUBLE

to order literature headed by a key number.
Just use the post card bound in this issue.

(178) Planers

Liberty Planer Catalog. 12 pp. Liberty Planers, Hamilton, Ohio. This catalog illustrates the latest developments which have been incorporated in the design of every type planer in the Liberty line.

Screw Thread Data

Defense Emergency Screw Thread Data Book. 24 pp. 15c. The Eastern Machine Screw Corporation, New Haven, Conn. This book contains a great deal of data on both foreign and domestic thread systems and should be a valuable aid to companies working on defense contracts. Please order copies of this book direct from the publisher, mentioning THE TOOL ENGINEER.

New Book by the Author of Machine Design

Mechanism. 372 pp. $3.50. By Stanton E. Winston, A.B., B.S., A.M., M.E. Associate Professor of Mechanical Engineering, the Illinois Intitute of Technology. American Technical Society, Drexel Avenue at 58th Street, Chicago. This is a fundamental book relating to the theory of the modifications and transmission of motion. It is written in a clear, "How-to-do-it" manner, and does not resort to the calculus. Difficult points are based on something the reader already knows, allowing him to gradually build up his knowledge of mechanism with each new step made easier by careful association with some factor already understood. Please order copies of this book direct from the publisher, mentioning THE TOOL ENGINEER.

SKILSAW DISC SANDERS
WORK BETTER . . . FASTER . . . ON
ALL PRODUCTION SURFACING!

NOW, more than ever, you need SKILSAW DISC SANDERS in your plant . . . for finer, faster finishing and for lower costs! SKILSAW DISC SANDERS are built to do more work for you. The same tool that grinds down raised welds one minute can surface for painting the next. They file, grind, buff, sand and polish . . . with grinding wheels, wire brushes, polishing bonnets, rubbing pads and sanding discs. They work on flat, concave and convex surfaces . . . of wood, metal, stone, tile and compositions. There's almost no limit to the surfacing jobs they can do . . . and on every job they save more time, more money. 5 POWERFUL MODELS.

YOU'LL FIND JUST THE TOOL YOU NEED IN SKILSAW TOOLS

SKILSAW 9 MODELS

DRILLS 22 MODELS

DISC SANDERS 5 MODELS

BELT SANDERS 4 MODELS

Also Blowers, Hand and Bench Grinders, Floor Grinders.

SKILSAW, INC., 5051 Elston Ave., Chicago

36 East 22nd Street, New York—52 Brookline Avenue, Boston—15 S. 21st Street, Philadelphia — 29 North Avenue, N.W., Atlanta — 182 Main Street, Buffalo—2902 Euclid Avenue, Cleveland—1535 Grand Avenue, Kansas City, Mo.—918 Union St., New Orleans—2124 Main St., Dallas 2645 Santa Fe Ave., Los Angeles—2065 Webster St., Oakland—1115 E. Pike St., Seattle. Canadian Branch: 85 Deloraine Ave., Toronto.

SKILSAW PORTABLE ELECTRIC TOOLS

YOUR DISTRIBUTOR WILL GLADLY DEMONSTRATE THESE TOOLS ON YOUR WORK

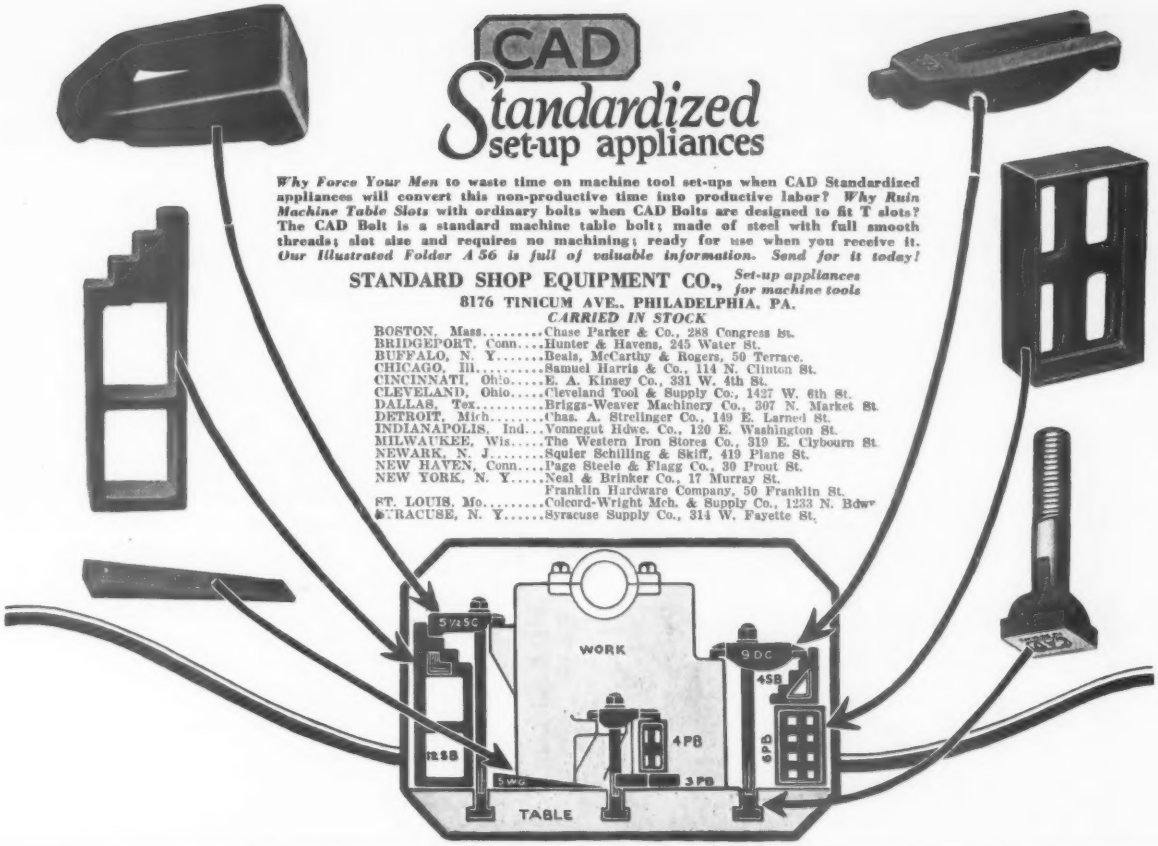
CAD Standardized set-up appliances

Why Force Your Men to waste time on machine tool set-ups when CAD Standardized appliances will convert this non-productive time into productive labor? *Why Ruin Machine Table Slots* with ordinary bolts when CAD Bolts are designed to fit T slots? The CAD Bolt is a standard machine table bolt; made of steel with full smooth threads; slot size and requires no machining; ready for use when you receive it. *Our Illustrated Folder A 56 is full of valuable information. Send for it today!*

STANDARD SHOP EQUIPMENT CO., *Set-up appliances for machine tools*
8176 TINICUM AVE., PHILADELPHIA, PA.

CARRIED IN STOCK

BOSTON, Mass.	Chase Parker & Co., 288 Congress St.
BRIDGEPORT, Conn.	Hunter & Havens, 245 Water St.
BUFFALO, N. Y.	Beals, McCarthy & Rogers, 50 Terrace.
CHICAGO, Ill.	Samuel Harris & Co., 114 N. Clinton St.
CINCINNATI, Ohio	E. A. Kinsey Co., 331 W. 4th St.
CLEVELAND, Ohio	Cleveland Tool & Supply Co., 1427 W. 6th St.
DALLAS, Tex.	Briggs-Weaver Machinery Co., 307 N. Market St.
DETROIT, Mich.	Chas. A. Strelinger Co., 149 E. Larned St.
INDIANAPOLIS, Ind.	Vonnegut Hdwe. Co., 120 E. Washington St.
MILWAUKEE, Wis.	The Western Iron Stores Co., 319 E. Clybourn St.
NEWARK, N. J.	Squier Schilling & Skiff, 419 Plane St.
NEW HAVEN, Conn.	Page Steele & Flagg Co., 30 Prout St.
NEW YORK, N. Y.	Neal & Brinker Co., 17 Murray St.
	Franklin Hardware Company, 50 Franklin St.
ST. LOUIS, Mo.	Colcord-Wright Mch. & Supply Co., 1233 N. Bdwy
SYRACUSE, N. Y.	Syracuse Supply Co., 314 W. Fayette St.

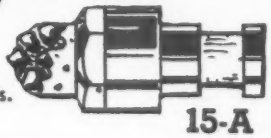


SMITITE Diamond Tools for WHEEL DRESSING

Dependable IN OPERATION

Easy TO ORDER

Contain finest quality Brazilian diamonds.



20-A

15-A

There is a tool for every grinding application, faultlessly crafted, efficient in operation. Each diamond is carefully selected for hardness, size, shape, and structure. The improved holding medium and the FORCED METHOD of mounting insure perfect application, low initial investment, and lower dressing costs.

J. K. SMIT & SONS, INC.
157 Chambers Street, New York, N. Y.
7 South Main St., West Hartford, Conn. Law and Finance Bldg., Pittsburgh, Pa.
Detroit — Chicago — Seattle

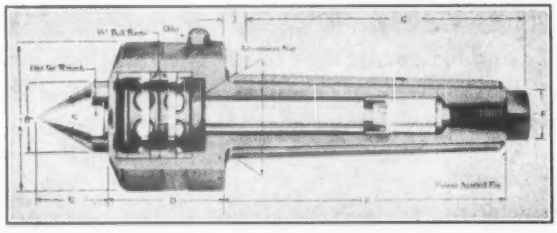
The Improved Nielsen Live Centers

LOAD CAPACITY—200 TO 40,000 LBS. AT 100 RPM.

HAVE ADJUSTMENT TO TAKE UP WEAR AND PRELOAD BEARINGS

STANDARD MORSE TAPER No. 2 TO 6 IN STOCK

WRITE FOR CATALOGUE AND DISCOUNTS



NIELSEN, INCORPORATED

LAWTON, MICHIGAN

Handy Andy Says—

THE Show is over, the curtain rung on another drama of A.S.T.E. success, a drama that, incidentally, was leavened by its bits of comedy, its interludes of reunion and sociability. The celebrities were there, spoke their pieces and got their pix in the papers, while comers, looming on the industrial and engineering horizons, stood as if in the wings, awaiting their cue for later entry. Others, again, made their final exits, henceforth to watch the pageant from the gallery or, in a pinch, do their "bits" as extras. The A.S.T.E. strengthened its position as a power in the engineering world, will now go on as usual, aspiring toward new objectives. For it is an axiom of success that, a pinnacle achieved, one looks for new peaks to scale. Excelsior!

▼ ▼ ▼

In the previous issue, I suggested that, when the time came to write *finis* to the column, I would like to leave my readers with a laugh, or, as an alternative, with the impress of a lasting thought. Well, the wish is there, but I am afraid that fulfillment will fall far short of desire. There are so many things to think of, these days, yet, there is one common interest that we share:—our homes and our economic security. And the twain may as well be one, for somehow, the heart of the world centers on the home, and without economic security the home rests on precarious ground. Strangely enough, the very unrest of the times, the labor strife and international outlawry, has its genesis in a commendable desire for economic security. The motive is sound, but the means to an end debatable. For to achieve it, class rises against class and predacious nations menace the security of their neighbors and destroy their homes, the whole a grim comedy of errors that defies reason. For, the moneys expended on war, if diverted to construction, would long since have assured economic security for all of the peoples of the world. Think that over.

▼ ▼ ▼

Economic stricture impels nations to take to the sword and coheres the masses of labor and prompts them to rise against a class which, they have been led to believe, is comprised of their economic masters. But, since the dawn of history there have been class wars, and we still have classes; a little while of the new, and the old order returneth. And largely, history is an account of ceaseless and futile wars rather than of material or spiritual progress. Yet, all the wars that man has waged have not altered the profiles of the continents a jot, nor has all the blood spilled throughout the ages tinted the waters of the seas by as much as a shade. But for a few notable exceptions that prove the rule, (exceptions that have established spiritual freedom) the epitome of human stupidity can be written in the one word—WAR! High time, then, that we find a better way to settle international differences and to achieve the economic salvation of man. For here, I am concerned with the practical, material things; let the preachers and the Utopians deal with the spiritual. Each to his field.

▼ ▼ ▼

Behind all economic struggle there is a basis of greed. The haves would have more and the havenots would divide the wealth of the haves, by force if necessary. Of late, however, and especially with the advent of the new industrialists, there has been evinced a desire to share with the less fortunate. But, it has not been impressed upon the masses that the way to achieve economic security is not to divide wealth, or to destroy it,

YOU CAN USE MOLINE HONING ACCURACY

No. 15 Single Spindle Hydraulically Reciprocated Honing Machine equipped with Moline hone and fixture for three kinds of motor blocks.

Moline Honing Machines give that accurate finish which passes exacting inspectors and speeds production. For those mass production jobs, multiple spindle honers are built, and fixtures are built to suit any job. These machines perform equally well for cylinder liner sleeves, brake drums, steel and cast iron bushings, etc.

—Your inquiries will receive prompt attention—

BORING - HONING - DRILLING - TAPPING - SPECIAL MACHINERY

MOLINE TOOL COMPANY

MOLINE, ILLINOIS Cable Address "Holehog" Moline ESTABLISHED 1901

ARMSTRONG

Always the stiffest possible bar.

One big advantage of an ARMSTRONG 3-Bar Boring Tool is that with 3 instantly interchangeable bars, it permits the stiffest possible bar for every boring and inside threading operation. Each is really 9 tools in one, because each of the 3 bars takes 3 end caps which hold cutters at 90, 45, and 30 degrees respectively.

This tool holder replaces the tool post, a single set nut releases (or locks) both holder and bar. End caps which can be changed without removing the bar, are smoothly finished with no projecting set screws or hardened nuts to mar the work. The ARMSTRONG "automatic set screw" cannot loosen in work, yet instantly releases cutter for change or removal.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
360 No. Francisco Avenue, Chicago, U.S.A.
Eastern Warehouse & Sales: 199 Lafayette St., New York

Buy ARMSTRONG Tools from your Jobber

Columbia TOOL STEEL

SUPERDIE

High Carbon, High Chromium

- **Safe**
- **Dependable**
- **Long Wearing**

The outstanding cutting die steel choice for today's needs.

It pays to use Good Tool Steel.

COLUMBIA TOOL STEEL COMPANY
ARTHUR T CLARAGE PRESIDENT
GENERAL OFFICE AND WORKS
580 EAST 14TH. STREET • CHICAGO HEIGHTS, ILL.

For Fast, Dependable TAPPING . . .

You can't beat the tried and proved

Ettco-Emrick

TAPPING EQUIPMENT

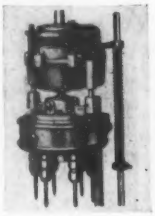
Perfected through 20 years of specialization in machine tapping, Ettco-Emrick equipment will positively give you the fastest tapping production you can get—and keep your tapping and tap costs down to a minimum.

TAPPING ATTACHMENTS AND TAP HOLDING CHUCKS

Featured by a 100% positive, yet exceptionally sensitive friction clutch, these attachments make possible top tapping speed while providing full tap protection. Readily attached to any drill press. Sizes for No. 0 to 1" taps. For full details send for **Bulletins No. 2 and No. 6.**

MULTIPLE TAPPING HEADS

Made up entirely of **stock parts** arranged and assembled to fit specific multiple tapping needs. This exclusive Ettco-Emrick system provides the **quick, low-cost way to increase tapping production.** Heads can be used on any drill press. Get full details in **Bulletin No. 3.**



TAPPING MACHINE

Embodying every feature essential to fast accurate tapping with maximum tap protection and minimum operator effort, this machine has a productive capacity up to 12,000 holes tapped per hour. Complete details in Bulletin No. 4. Copy on request.

AT YOUR SERVICE...

The benefit of our 20 years of experience with all kinds of tapping problems. Our recommendations are yours without obligation. Write us.

ETTCO TOOL CO.

586 Johnson Ave., Brooklyn, N. Y.
DETROIT **CHICAGO**

The Famous Ettco-Emrick DRILL CHUCKS • TAP HOLDING CHUCKS
TAPPING ATTACHMENTS • TAPPING MACHINES
MULTIPLE SPINDLE TAPPING AND DRILLING HEADS
Unexcelled for Design, Materials and Workmanship

but to create more wealth. And that is one of the transient troubles of the world, that masses hitherto comparatively ignorant have been educated (or miseducated, if you prefer) into a false line of reasoning. Pseudo-intellectuals and rabble rousers have preached false doctrines, and the masses have accepted them as messianic messages. Why not? — the mossbacks, conservative but stupid, have as stubbornly resisted changes designed to create better conditions. The result is that the safe middle way has been deserted for the extremes of leftism and rightism, and thinkers who have tried to reconcile the extremes have been but voices crying in the wilderness.

▼ ▼ ▼

The prospect is dark, but not so dark that the silver lining of hope has been entirely eclipsed by the clouds of gloom. For with one exception (and that a nation which has prided itself on its cultural superiority) the more educated and intelligent of the world's peoples have learned to refrain from violence. For them, a practical credo of live and let live; for them, orderly evolution and intelligently directed progress rather than revolution and planned destruction. Such peoples have established that employers and workers can cooperate to mutual advantage, enhancing national wealth and promoting mass standards of living. They have shown that economic security can be achieved even though the natural resources of their lands are limited as compared to alleged havenots who, regardless of their vaunted cultural superiority, have not learned to use their patently vaster resources for their own economic salvation. The latter, by the very act of aggression, are self confessed inferiors when it comes to evolving a design for living. Well, the point is that we have been shown the way to economic security, and, the fact established, we can study the model with a view toward a future, universal design. There is also the point that, unless armed and keyed to eternal vigilance, the higher civilizations are prey to the predator.

▼ ▼ ▼

Sometime ago, the President implied that America has a rendezvous with destiny, and somehow, the implication is fateful. For certainly, we are faced with a grave issue; the future of civilization rests in the hands of the American people. We are, potentially, the wealthiest nation on earth, as we are a potential force for good. We have the power and the resources to champion the weak and to vindicate a pledge of support to another great power now engaged in a death struggle to maintain a more or less common ideology. I do not presume to question the pledge, nor to debate the right or wrong of the issues involved. We have been pledged to a cause, and the pledge determines the fact. Therefore, we should make ready, all of the workers of America, professional as vocational, united in a common cause:— the preservation of our national integrity. For, we are fast approaching our rendezvous with destiny, and lesser issues must be subordinated to the vital consideration of the moment. But, let us temper haste with caution, that we conserve our strength. For, when this thing is over, and European civilization lies prone and exhausted, there must remain one power strong enough to police the ruins and inspire regeneration. It is fated that America is to be that power.

▼ ▼ ▼

For the Tool Engineers, and for all of the engineers of America, there is also a rendezvous with destiny. To us, and to the men of science, has been given the ability to create and to seek out new sources of wealth. With the development of resources, and the employ-

Strength where you need it!

If you're using cemented carbide blades think of using LOVEJOY Mills

The rugged design of LOVEJOY Milling Cutters makes them ideal on work requiring the use of cemented carbide blades. The carbide tips on LOVEJOY blades are backed up with ample metal to withstand the greatest strains imposed by the higher speeds necessary for increased production. And LOVEJOY Mills utilize practically the entire tip on the blade, thereby reducing blade cost to a minimum. *It takes a LOVEJOY MILLING CUTTER to extract the last cent of profit from every milling cutter job.*

Ask for Catalog No. 26 for complete details on the modern LOVEJOY line of milling cutters.

LOVEJOY TOOL CO., Inc.
Springfield, Vermont

Just ONE set-up for every weld

Save valuable time in welding, handling; do better "downhand" welding—all with more safety, by using a C-F Positioner. Cut down crane service on large unwieldy work by "setting-up" just once for all welds. C-F Positioners are made in hand and power operated models with a variety of control features suitable for all kinds of work. Send coupon today for complete information about these remarkable welding machines which give every advantage to today's production demands.

CULLEN-FRIESTEDT CO.
Gentlemen: Please send circular No. W-P20:
Name.....
Title.....
Address.....

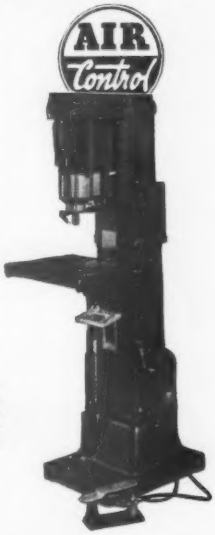
Circular No. W-P20 describes C-F Positioners from 1,200 to 14,000 lb. capacity.

CULLEN-FRIESTEDT CO.
1318 S. KILBOURN AVE. CHICAGO, ILLINOIS

Why Rob Peter to Pay Paul?

WHY sacrifice tapping **speed** for tapping **accuracy**—or vice versa? Haskins gives you ***both***—in **one** machine. Gives you Class 3 and 4 fit—***plus*** production increases. The Haskins Type C Tapper is even tapping to ***micrometer*** accuracy — and ***doubling*** production—for a leading manufacturer of micrometers!

We believe this ***air-controlled*** tapper can cut costs, decrease tap breakage and increase tapping production in your plant, too. Put us to the task of proving it!



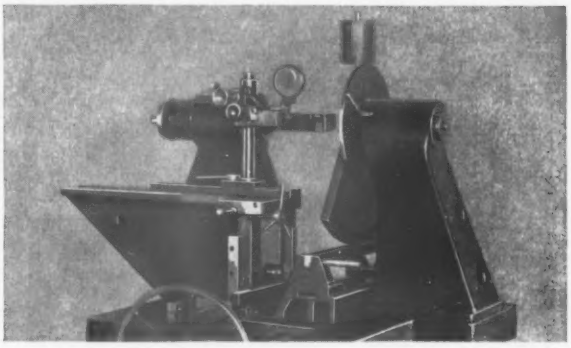
FREE BOOKLET gives complete information about the Haskins Type C Tapper and the three capacities in which it is available. Write for it. R. G. Haskins Company, 2756 W. Flournoy St., Chicago.

HASKINS
R. G. HASKINS CO.

THOSE WHO MAKE HARDNESS INSPECTION TESTS ARE BUILDING GOOD WILL...FOR THE ONLY FOUNDATIONS OF GOOD WILL IN BUSINESS ARE GOOD PRODUCT AND FAIR DEALING

"ROCKWELL"
HARDNESS TESTER

WILSON
MECHANICAL INSTRUMENT CO., INC.
Concord Avenue, N. Y. City



The New VINCO INVOLUTE CHECKER

For Fast, Accurate Inspection of a Wide Range of Spur and Helical Gears

The Vinco Involute Checker is built for the inspection of spur and helical gears from the smallest to 24" pitch diameter and will take 19" between centers with the standard tailstock slide. Its outstanding feature is the application of the sine bar principle—the correct method for checking involute curves. No base circles are employed, as proper sine bar setting will give any needed correct timing. Gears are located between centers and are checked in a horizontal position, in contrast to the usual methods employed on vertical type machines.

Write for full information on this and other precision products manufactured by Vinco.

VINCO Corporation
9133 SCHAEFER HIGHWAY DETROIT, MICHIGAN

ment resulting, there will come improved standards of living and that economic security for which men now vie in the arena of war. Speaking for myself, I believe that an equitable design for living can be worked out. The concept is there, already proven, and we have the fact that, in an ordeal of social and economic experiment, America is trying to provide social gains and economic security for the masses of the people. And that is what the struggle is all about, isn't it? But, it is going to take brains and leadership, and unselfish principles, to bring the experiment to a successful conclusion. The engineers of America have the brains and the leadership, and who knows but what Destiny beckons from a peak we have not as yet scaled?

▼ ▼ ▼

Well, I have stated a proposition without going into detail; I have left the seed of a thought with a hope that, falling on fertile ground, it will root and flourish. There should be no better ground than the composite engineering mind, a mind at once cold and analytical yet fertile in that it is trained to deal with abstract as concrete problems. We can devote that mind to no nobler purpose than to improve the design of living for our fellows. With that thought, Handy Andy bids you

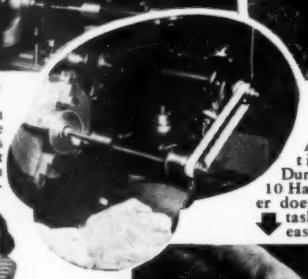
Au Revoir.

Accuracy in Action!

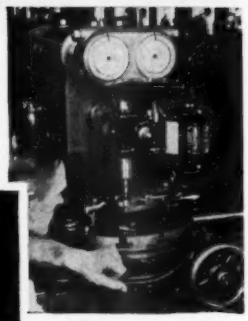
Scully-Jones and Co., Chicago manufacturers of tools, call upon the versatile No. 5 to provide .0001" accuracy on a production job.

Dumore precision Grinders have played an important part in the development of modern tractor power.

Accurate tools and dies are essential in making fine watches. Here's another No. 5 at the Hamilton Watch Co., Lancaster, Pa.



A vibrationless Dumore No. 10 Hand Grinder does "tricky" tasks quickly, easily.



Doing one of 57 operations on an exacting motor lamination die . . . a typical Dumore precision job.

The New Departure Div. of General Motors has helped revive bicycling with better bearings and brakes. Dumore Grinders are used in their plants.

Dumore No. 5 "Master"

Dumore PRECISION Grinders

Precision grinding reaches greater importance every day as the demand for accuracy in industry becomes greater. Originally introduced as a tool and die room accessory 25 years ago, Dumore Grinders, because of their wide versatility, have been drafted into use on production lines where they assure a better product while reducing labor costs, overhead charges and spoilage. There's a Dumore industrial distributor near you who will give you full facts . . . without obligation.

THE DUMORE COMPANY
Dept. 221-D Racine, Wis.

High Speed Steel Users Can Avoid Artificial Pressure

The rate at which new plants using machine tools go into operation will be the big factor in determining whether high speed steel production is ample to meet all normal and emergency needs, it was pointed out recently by L. Gerald Firth, president, Firth-Sterling Steel Company. "The pressure of demand for high speed steel should ease off when the nation has passed the crest in the opening of new factories," Mr. Firth said.

"The original tooling requirements of new plant are, in the usual instance, greatly in excess of its monthly tool consumption. It is pretty much like a couple setting up housekeeping: once their furnishings and supplies are installed their replacement needs are nominal. A new machining plant may need as much as 10 tons of tool steel to provide for all layouts and set up for initial operation; thereafter, replacement of consumed tools may be at the rate of less than a ton per month."

The extent to which this initial tooling up has affected purchases of high speed steel is indicated, Mr. Firth explained, by a comparison with 1929, the previous peak period for tool steel production. "High speed steel production during 1929 was in the neighborhood of 14,000 tons, whereas the present demand is at an apparent yearly rate of more than 20,000 tons. This increase is all the more significant when we remember that improvements in tools and tooling since 1929 have resulted in a great deal more production per tool. And it must be considered also that a great many machining jobs have been taken over by the sintered carbides.

"It is difficult to explain this increase in demand unless we attribute it to the rapid construction of new plants. The rate at which such extraordinary construction continues will largely determine the intensity of pressure on tool steel production facilities. Meanwhile, producers and users can guard against creation of artificial pressure by keeping purchases as nearly as possible in line with consumption, thus avoiding building up excess stocks."

NOTHING BETTER

● Chicago Rawhide hammers and mallets, made from genuine Java Water Buffalo hide, are a first choice wherever pounding must be done on surfaces that must not be damaged.

Accurate—Economical

Hammers have malleable iron heads—an indestructible feature—and replaceable faces.

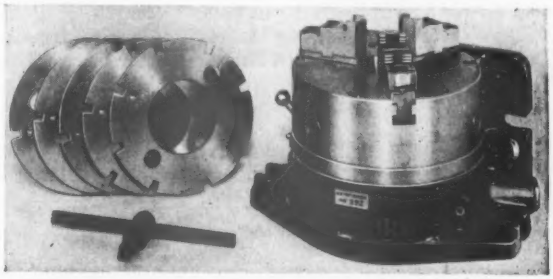
Mallet heads are tightly coiled and riveted —made to strike hard blows without "mushrooming", splitting or chipping.

● Chicago Rawhide Tools are available thru your supply dealer. Ask him to demonstrate the quality of these tools.

CHICAGO Rawhide MFG. CO.
1393 - ELSTON AVE · CHICAGO · U·S·A

HARTFORD *Super Spacer*

SO ABSOLUTE EVEN UNSKILLED OPERATORS CAN HANDLE IT



Because it provides accurate indexing, even under heavy cuts, you can operate your milling and drilling machines, slotters and planers at faster speeds and feeds—thus saving you time and money. Efficient in production as well as in tool room. No modern shop without it.

Write today for descriptive circular

THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD, CONN.

When You Specify BARNES HYDRAULICS

● You buy more than equipment — you buy an engineered application. Designed and built for the job to be done.

As designers and builders of hydraulic units, panels, control valves, and pumps for manufacturers in a wide range of industries, we are in excellent position to solve your hydraulic problems and supply the necessary equipment.

And what's more — users of Barnes Hydraulics over a period of many years under most severe operating conditions report maintenance costs at an absolute minimum—lowest by comparison.

That's why careful buyers specify

BARNES HYDRAULICS

Send us your inquiries with information about the job to be done. We'll be glad to submit a proposal or if you say so, we will have an engineer call.

John S. Barnes Corporation

DETROIT SALES OFFICE
503 NEW CENTER BLDG.
TR-1-1706

MAIN OFFICE AND FACTORY
ROCKFORD, ILL.

IMMEDIATE DELIVERY

AUTOMATICS
3" Model B Acme 4-spindle, M.D. (4)
No. 1 Brown & Sharpe: Motor Drive
1½" Cleveland 4-spindle Model M., M.D.
1¼" Gridley 4-spindle Model F., SPD.

DRILLS
No. 1A Edlund H.S.B.B., 4 Spdl., Power Feed, M.D.
3½' Fosdick Heavy Duty Plain Radial, M.D.

GRINDERS
16" x 36" Norton Crankpin, C/S
6" x 32"; 10 x 18, 24, & 36 Norton Plain
No. 14 Brown & Sharpe Plain, M.D.
No. 255 Heald Rotary Surface, 12" Mag. Chuck
No. 2 Brown & Sharpe Universal, C/S

LATHES
18" x 10' Hendey Yoke Head, M.D.
24" x 10' Schumacher-Boye, Quick Change, C/S

MILLING MACHINES
No. 2B Rockford Universal: Dividing Head, Vertical & Slotting Attachment, Rotary Table, M.D.

PLANERS & SHAPERS
44" x 44" x 18' Niles Tool Works, 4 Heads
30" x 30" x 18' Gray, 2 Heads
30" x 30" x 8' Smith-Silk, 1 Head
22" x 22" x 5' Whitcomb, 1 Head
14" Gould & Eberhardt Shaper; Vee Ram, M.D.
24" Rockford Heavy Duty Shaper: Motor Drive

PRESSES
No. 661 & 663 Toledo Coining & Embossing
No. 14 Toledo Horning, Motor Drive, 5" stroke
No. 94 and No. 95 Bliss Solid Back

MACHINE TOOLS — POWER PRESSES

OTT MACHINERY SALES INC.

546 Second Ave. — Detroit, Mich.

» » A.S.T.E. DOINGS « «

By IRWIN F. HOLLAND

Baltimore

The regular monthly meeting was held March 5, with approximately 75 members and guests attending the dinner and meeting. After a very good steak dinner a short meeting was held, at which Mr. Nils Lou our retiring Chairman installed the new officers for the coming year. The new officers are as follows: Godfrey Steiner, Chairman; Mr. Beamie, Vice Chairman; Leslie MacGregor, Secretary; John O'Connor, Treasurer.

Incidentally, Mr. O'Connor has been Treasurer of the Baltimore Chapter since its organization.

At the meeting, the Chapter's new Bausch & Lomb projector was on display. Our speaker for the evening was Mr. V. R. Parker of the E. W. Bliss Co., who gave a fine talk on "The Application of High Speed Automatic and Hydro-dynamic Presses." He illustrated his talk with a good movie, which showed presses in operation. Mr. Parker also had a few samples of work on display that were made on high production presses.

2 NEW 8-PAGE FOLDERS
To Keep You Up-To-Date
On Deliverable* Plant Equipment

* Busy as we are, meeting the skyrocketing demand for more and more Boice-Crane tools, deliveries—all types—are good to prompt.

Write TODAY for them and unload many of your tooling headaches right here NOW! Expand production easy, on drilling, tapping, straight and contour cutting jobs with Boice-Crane Drill Presses and 8-speed Metal Cutting Band Saws. No long delivery delays!

1

New 8-Speed Band Saw

Cuts Everything — Metals, Fibre, Wood

Handiest Tool in the Shop

The New Boice-Crane is the perfect small Band Saw for production, tools and dies, foundry and experimental work. Built just like expensive machines. 8 speeds 75 to 2200 ft.p.m. Powerful gear drive. Internal, external, straight and contour cuts.

Over 60 Models in Drill Presses

for Production, Tool Room, or the Job Shop
Bench or Floor Types—Singles or Multiples

There's a world of help and valuable information for you in the new Boice-Crane Drill Press Folder! 64 different models, and parts for making special purpose machines, to solve a host of tooling jobs. Prices low—and what punishment they take!

2

Write Today
FOR YOUR FOLDERS

BOICE-CRANE COMPANY 1717 NORWOOD AVE. TOLEDO, OHIO

Buffalo

Buffalo-Niagara Frontier Chapter turned out 125 strong at the Feb. 27th meeting to pay tribute to our National President A. H. d'Arcambal. In addition to his timely topic on "Machinability" he also gave singular praise to J. Don Reep for his efforts in sponsoring Chapters throughout New York State, and to Otto Winter for his fine work on the Educational Committee. Chairman George Keller was also congratulated for his advancement of the Buffalo Chapter during the fiscal year. Preceding Mr. d'Arcambal's talk, the following members were elected to office for the coming year: Allen C. Siegel, Chairman; Claire Crofoot, Vice Chairman; William Noth, Secretary; Frank Wilson, Treasurer. Immediately following the election of the Buffalo Chapter, J. Don Reep, our first Chairman with a few appropriate words presented to George Keller retiring Chairman a solid gold, diamond studded, Past Chairman's pin as a token of esteem and appreciation from the Chapter.

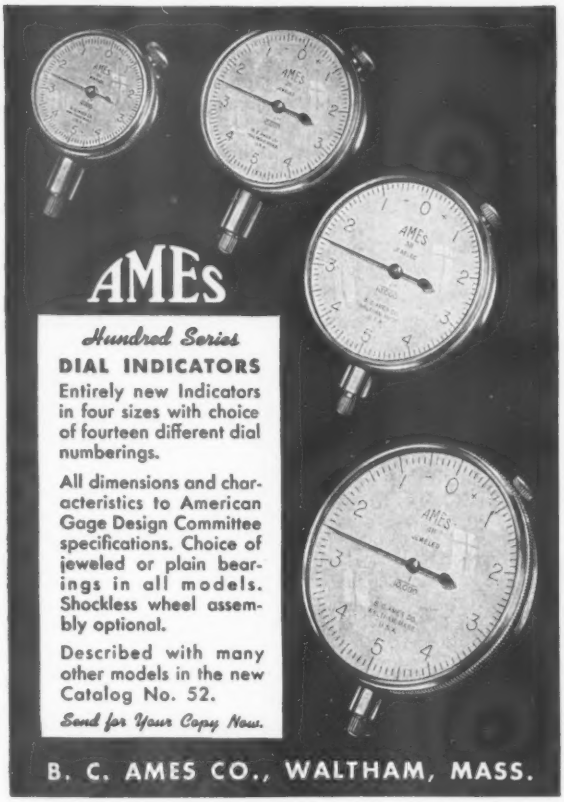
This meeting was one of the finest ever held, and we are looking forward to an early return of Mr. d'Arcambal with further reports on the advancement and accomplishments of the National Organization whose aims and ideals were enthusiastically unfolded.

Cincinnati

The Cincinnati Chapter of the A.S.T.E. met March 11, 1941 at the Ohio mechanics Institute.

The meeting was opened by Chairman Jim Fredericks who introduced the speaker of the evening who spoke on the subject of "Better Methods begin with the Tool Engineer." Mr. Guy J. Bates who intended to give this talk was unavoidably detained so he asked his colleague, Mr. Mc Gee, of Inland Mfg. Co. to take his place for this meeting.

Mr. Mc Gee was an able speaker and he fully described the problems encountered by many Tool Engineers when working out new manufacturing equip-


AMEs
Hundred Series
DIAL INDICATORS
Entirely new Indicators in four sizes with choice of fourteen different dial numberings.
All dimensions and characteristics to American Gage Design Committee specifications. Choice of jeweled or plain bearings in all models. Shockless wheel assembly optional.
Described with many other models in the new Catalog No. 52.
Send for Your Copy Now.
B. C. AMES CO., WALTHAM, MASS.

WORLD'S GREATEST all around
ELECTRIC TOOL

DRILLS • GRINDS • SANDS
SAWS • POLISHES
SHARPENS • CARVES

The new WHIZ ELECTRIC TOOL is the handiest power tool ever made. A rugged tool for power and precision work. Drills thru ¼ inch iron plate in 42 seconds or engraves intricate designs. Handles any material: Metals — Woods — Alloys — Plastics — Glass — Steel — etc. Saves time. Eliminates labor. Plug into any socket AC or DC, 110 volts. Chuck ¼ inch capacity. Ball bearing thrust. Powerful, triple-geared motor. STANDARD MODEL with Normal Speed (uses 200 different accessories instantly interchangeable). Price only $7.95.

The only DRILL-TOOL with a full year's guarantee.

FREE Accessory outfit (Value $2) includes set of drills, mounted 1½ inch grinder, sanding discs, cutting wheels, mounted brush, polishing wheel, carving burr, etc. FREE with each Tool ordered NOW. We pay postage.

10-DAY TRIAL—MONEY BACK GUARANTEE

PARAMOUNT PRODUCTS CO.
Dept. 4 TEN 545 Fifth Ave. New York, N. Y.

Brightboy

for FINISHING, PRE-FINISHING
POLISHING and PRE-POLISHING
METALS

The Binder is SOFT RUBBER
It CUSHIONS *the Abrasive*

Leaves a bright, smooth polished surface

Made in DISCS, WHEELS and TABLETS

Write for Samples
WELDON ROBERTS RUBBER CO.
Newark, New Jersey, U. S. A.

For Accuracy Speed Economy
COPPER HEAD LAPS

ACCURATE—because of practical scientific design and manufacture.

SPEEDY—because they are always ready and quickly adjustable to size; the abrasive compound of proper consistency works into the copper, the best known lapping medium.

ECONOMICAL—because copper sleeves, the only wearing part, are quickly renewable after long wear.

Available in all standard fractional sizes, ⅛" to 2".

Write For Circular and Prices

BOYAR-SCHULTZ CORPORATION
2116 Walnut St., Chicago, Ill.

ments and when improving present methods.

A number of motion picture films were shown to illustrate present production methods and then the same operations were shown after improvements were made at little cost by the Tool Engineer. These films proved very interesting and brought out many questions from the members and their friends attending the meeting.

At the conclusion of Mr. Mc Gee's talk questions were answered from the floor and all gave Mr. Mc Gee a rising vote of thanks for the talk and pictures.

The meeting then adjourned for refreshments and a general greeting between friends.

Dayton

The Dayton Chapter's March meeting held at the Gibbons Hotel March 10th was one of the best turnouts as well as one of the most interesting programs of the year. Our Meeting Chairman, Whitey Poock, put on a marvelous dinner of breast of guinea hen which was enjoyed by the large crowd.

A very interesting movie short entitled "Rough and Ready" was shown through the courtesy of the Simonds, Worden, White Company of Dayton, Ohio. Mr. Nels G. Johnson, Sales Manager of the Simonds, Worden, White Company, addressed the gathering for a few minutes regarding the picture and told a few interesting stories.

The event of the evening was a talk by Mr. Frank O. Hoagland, Master Mechanic of Pratt & Whitney Company, who gave a very interesting talk on "Progress in Machine Tool Design." Through the use of slides and charts Mr. Hoagland gave a brief history of the development of machine tools from many early designs up to the present day streamlined machine tools which are now going into new defense plants all over the country. He also outlined the necessity of mass production in the machine tool industry in order to take care of the defense program, and by the use of up to date machine tools and as many automatic machines as possible produce sufficient ammunition, guns, and aircraft engines to relieve as many men as possible from front line duty, pointing out that the more men that could be released the better the chances were of winning a war in the shortest possible time.

We were sorry to learn that our Secretary, Howard C. McMillen, was laid up, believe it or not, with the measles, and we trust that he will have recovered so as to be present at our next meeting.

It was suggested that the Chapter as a group try to get together at Detroit during the Machine & Tool Progress Exhibition, and we are hoping that the boys do not have any difficulty locating each other there.

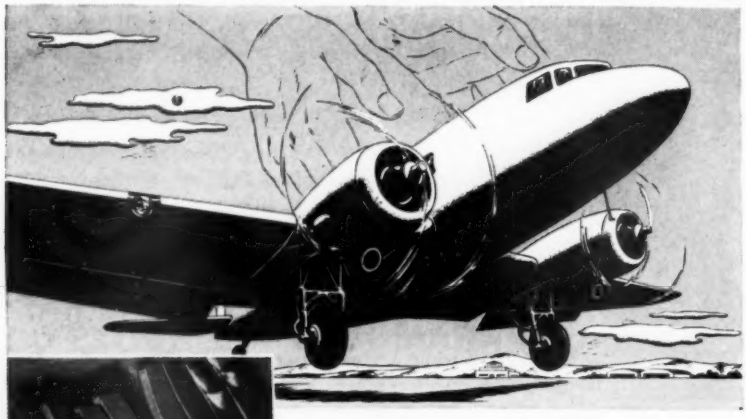
Hartford

The technical session of the March meeting was held at our previous meeting hall—the Hartford Gas Company Auditorium, preceded as usual by a dinner at the City Club.

Ray Morris made a plea for twenty-five new members, hoping to increase the membership to three hundred. He also urged all members to make reservations as soon as possible for the Tool Show as Detroit Hotels were being filled up rapidly.

An interesting experiment took place at this meeting in the nature of a very instructive dialogue between Mr. George Leitch and Mr. Arthur Merry on the subject "Symposium of Tool Planning." This dialogue was entirely unrehearsed and presented in a delightful way the problems a Tool Engineer faces today when the time element of tool planning is most urgent.

Both men stressed strongly the meth-



FORMING DIES... where AMPCO METAL'S hardness, its resistance to pitting, wear and impact result in exceptional accuracy and long life.

GEARS... the toughness and wear resistance typical of AMPCO METAL recommends it for all types of gears, ranging from a fraction of a pound to hundreds of pounds each.

BEARINGS... AMPCO METAL is probably more widely used for bearing service than any other bronze. It is noted for its stubborn resistance to wear, "squashing out" and shock loads.

Like *Protective Hands* for a

SAFE LANDING!

A critical moment—as plane and ground meet. If vagaries of wind and timing make the meeting a rough one, the landing gear must safely absorb severe impact. At points of greatest stress and shock in the landing gear of plane after plane, AMPCO METAL is used... undeniable proof of the greater strength and longer wearing qualities of this dependable bronze.

SPECIFIED *for the* "TOUGH" JOBS

In other industries, as in aviation, you'll find AMPCO METAL widely used wherever exceptional durability and resistance to impact, fatigue, wear and corrosion are required. It enjoys a unique reputation as "the metal that makes good when all others fail."

Have You a Problem of "Metal Failure"?

Maybe AMPCO METAL can master a troublesome job for you. It's made in many grades and forms. Tell our engineering staff what you're up against, and they'll be glad to supply complete data and recommendations.

There's no obligation. Write

AMPCO METAL, INC., Dept. TE-4, Milwaukee, Wis.

AMPCO METAL

The Metal Without An Equal

AMPCO

This JOHNSON Furnace Pot Hardens and Melts Quickly at Low Cost

JOHNSON NO. 550

Send for complete specifications on this Johnson Furnace, and you'll know that high temperatures can be had quickly, with less than half the gas consumption of ordinary units. Especially designed for economical salt, cyanide and lead hardening, for melting aluminum and nickel-silver. Tool and die makers, model and pattern makers will find this a time and money-saver!

With Steel pot 8"x10", complete with G.E. meter and blower, $112.

$112.00 F. O. B.

Johnson Gas Appliance Co., 603 E Ave., NW., Cedar Rapids, Ia. Available in other pot sizes.

Over 40th ANNIVERSARY YEAR

JOHNSON GAS APPLIANCES FOR EVERY INDUSTRIAL PURPOSE

603 E Ave., NW., Cedar Rapids, Iowa

Please send me full details on Johnson Furnace No. 550.

Name.....

Address.....

City..... State.....

PRODUCTION BOOSTERS

New

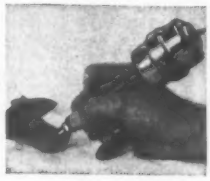
IDEAL LIVE CENTERS

SAVE HOURS ON CENTERING WORK

- Interchangeable Male and Female Inserts.
- Work with heavier loads at higher speeds.
- Save cost of fast-wearing dead centers.
- Timken roller bearing carries thrust load.
- Precision Built. All parts hardened and ground.

IDEAL ELECTRIC MARKER

- Permanently marks on all materials—glass, metal, ceramics.
- Used like a pencil.
- 7200 cutting strokes per minute.
- Special Alloy or Diamond Cutting Point.



10" swing
20" swing
42" swing
60" swing

IDEAL BALANCING WAYS

- Simplify balancing crankshafts, pulleys, flywheels, etc.
- Work carried on free-turning, special steel discs.

New

IDEAL "UNIVERSAL" METAL ETCHER

- Permanently marks on steel, iron and their alloys.
- Compact, everything enclosed.
- Four etching heats.
- Ground clamp for large work.

THREE OTHER MODELS ALSO AVAILABLE

Ask About Free Demonstration

IDEAL COMMUTATOR DRESSER COMPANY
4152 Park Avenue Sycamore, Illinois
Sales Offices in All Principal Cities
In Canada: Irving Smith, Ltd., Montreal, Que.

Reclinable POWER PRESSES

This press has long been considered the most suitable and favored type for general stamping work. Its features have been standard for a number of years, but many important improvements in details make the latest model outstanding. Its high performance is the result of thorough research, sound engineering and careful designing.

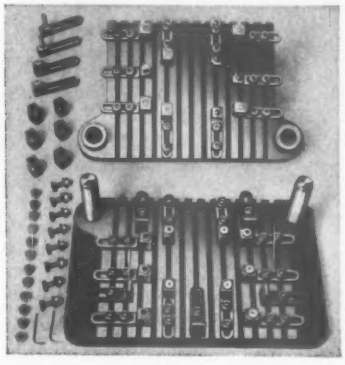
The Type 36 Press is available either plain or back geared, and the models range from 4 to 100 tons capacity.

Complete information on this and other Z & H presses will be sent on request.

ZEH & HAHNEMANN CO.
192 VANDERPOOL STREET, NEWARK, N. J.

PERFORATING DIES
100% ADJUSTABLE
SPEED UP PRODUCTION • CUT DIE COSTS

Whistler adjustable perforating and notching dies are ready to set up and start production. Can be quickly rearranged at no additional expense. Absolute precision. All parts interchangeable. Adaptable to any type press.



★ Whistler adjustable dies permit minimum perforating centers of ⅞".

★ Dies for perforating holes from 1/32" to 1½" in mild sheet steel to ⅛" thickness shipped from stock. Larger sizes on order.

★ Self cleaning.

★ No special tools required.

★ Operating satisfaction assured.

★ Used by country's largest manufacturers.

FREE *Fully illustrated catalog explaining Whistler adjustable dies, other production tools and special machinery will be sent on request.*

S. B. WHISTLER & SONS, INC.
736 MILITARY ROAD BUFFALO, N. Y.

WHISTLER ADJUSTABLE PERFORATING **DIES**

ods used in dealing with men as recommended by Dale Carnegie in his book "How to Win Friends and Influence People".

After the discussion period one of the members turned poetic by reading a very appropriate poem.

Houston

The regular March meeting of the Houston Chapter was held at Golfcrest Country Club, March 10, 1941. Dinner was served, and by a vote, the dinner meetings will be continued.

Chairman F. E. Doty, asked for a report of the publicity committee for the Machine & Tool Progress Exhibition. A report was made on what was to be seen and heard at Detroit, the advantages of going, and information on railroad schedules and fares, as well as road information for those who intended to drive.

It was announced that Mr. H. B. Madder, Vice Chairman had again resumed the Junior Classes which would be held weekly at the plant of the Kelley Manufacturing Co.

Program Chairman "Rip" Collins introduced the speaker of the evening. Mr. C. E. Kessler, Associated with the Ford Motor Company. Mr. Kessler kept the crowd interested for an hour and a quarter telling of some very interesting experiences while he was a member of Byrd's first Antarctic Expedition.

After a recess, a moving picture of "Our National Parks" was shown, followed by a film "The River Rouge Plant," showing a trip through the Ford Motor plant.

Tri-City (Moline)

Tri-City Chapter, held its regular monthly meeting on March 5th at the LeClaire Hotel, Moline, Illinois, with 130 Tool Engineers present at the dinner and meeting.

The speaker for this meeting was Mr. A. H. d'Arcambal, President of A.S.T.E. The subject of his address was "Machinability of Metals." He discussed many of the metallurgical advantages and disadvantages in regard to machinability. His lecture was illustrated with lantern slides and with many sample production tools. He also explained to the group the plans and purpose of the Machine and Tool Exhibition to be held in Detroit.

New York-New Jersey

The March meeting was held at headquarters, the Robert Treat Hotel in Newark, N. J. on the 11th. Due to miserable weather, the attendance was below par but those present found just the same great interest in a talk by Mr. W. B. Scott, of Ampco Metal, Inc. of Milwaukee, Wis. on Aluminum Bronze Alloys, accompanied by a great many slides. A lively discussion brought out additional information. The same company presented a colored film, taken at their plant, about Modern Alloy Production, which proved to be of more than entertainment value. The chairman of the meeting, Frank Malhiot, called particular attention to the Annual Meeting of the Society in Detroit at the end of the month and to the April 8 meeting of the Chapter, which will be held at Paterson, New Jersey under the sponsorship of the Wright Aeronautical Corporation of that city.

Philadelphia

Philadelphia Chapter No. 15 held its regular meeting on March 20. This was a closed meeting for members and prospective members that had their applications in before the time of the meeting. Eighty members attended the dinner with quite a few arriving later during the early part of the evening for the business meeting.

Chairman Paul W. Frankfurter Sr. introduced Mr. J. C. Heitman of the Standard Gage Co. as the speaker of the evening. His topic was "Johansson and

Timely
SUGGESTIONS
. . . for chuck users. Published by the Cushman Chuck Company in the interest of better service during the National Defense emergency.
Watch Chuck Lubrication

Cushman Chucks are built to "take it" but they deserve the same careful attention you give your fine machine tools - - - - - - -

Machines as well as men are working harder these days. They'll need a little more careful maintenance, closer attention to lubrication, for example, if we are to conserve important equipment while stepping up output. These unretouched photographs of a set of jaws recently returned to us . . . and a similar set of new jaws . . show how the useful life of a fine chuck can be shortened by lack of proper internal lubrication. There's really no excuse for this. Convenient grease gun nipples in all except the small sizes, make lubrication of Cushman Self-Centering Chucks easy. Simple shop cleanliness will prevent damage due to foreign materials entering chuck.

We suggest that you show this advertisement to the foremen and operators in your plant. Cushman Chucks will repay you for a little extra care . . . with maintained accuracy and longer service life.

The Cushman Chuck Co. - Hartford, Conn.

CUSHMAN CHUCKS
A WORLD STANDARD FOR PRECISION

Have You a Question?

. . . to ask about any items of new equipment described in this issue? Would you like to know more about them? Are any of the pieces of new literature listed on pages 130 and 132 likely to be of value?

If the answer to any of these questions is yes then there is a simple and easy way to secure the information you seek. Fill out a coupon on the post card folded into this issue for each piece of information you want. Then fill in the identifying number prominently displayed with each item in New Literature and It's New which applies to the item you are inquiring about. Mail us the card and we'll do the rest.

THE TOOL ENGINEER
"America in the Making"

Mark Iron, Steel and Carbides the

Etchograph

Way

•

2000 IN USE

NEW JUNIOR MODEL

Buy the Original Electric Etcher

Three sizes to meet all requirements. Also a combined Etchograph and Demagnetizer.

With New ELKONITE TIP Pencil

Mark hardened parts tools, dies, gages and fixtures of any ferrous metals including the hardest alloys and carbides — quickly — plainly.

Write for circulars and prices.

BREWSTER - SQUIRES COMPANY
54 Church Street
NEW YORK, N. Y. U. S. A.

EVANS HIGH SPEED STEEL REAMERS

WILL SHIP ON 30 DAYS' TRIAL

LOOK AT THESE FEATURES

- No honing.
- Will not chatter.
- Chrome-like finish.
- Perfect alignment.
- Full bearing surface.
- Left and right spirals.
- 50 to 80 thousandths expansion.
- Cannot fall in slots or oil grooves.
- Extension pilots for line-up work.

WRITE FOR CIRCULAR

EVANS FLEXIBLE REAMER CORPORATION
4539 Ravenswood Ave., Chicago, Ill.

FOR MODERN METAL CUTTING TOOLS

Specify

NATIONAL

NATIONAL TWIST DRILL & TOOL CO., Detroit, U.S.A.

TWIST DRILLS • REAMERS • HOBS • MILLING CUTTERS • COUNTERBORES • SPECIAL TOOLS

Tap and Die Division WINTER BROTHERS CO., Wrentham, Mass.

Factory Branches • San Francisco • New York • Chicago
Philadelphia • Cleveland • Distributors in Principal Cities

LOOK BEHIND YOUR INSPECTION PROBLEMS

with

SEE RITE MIRRORS
reg. U. S. pat. off.

Already in use in many aircraft factories for inspecting those vital, but hard to get at parts, SEE RITE mirrors are saving much valuable time and making inspections far more exact. Extension handles make possible examination of previously inaccessible units.

Six convenient sizes, ½" to 1½" diameters.

Plain or magnifying faces.

For further information, write to

ANZELL SPECIALTY MANUFACTURING CO., Inc.
39-45 Front Street Brooklyn, N. Y.

World's largest manufacturers of quality mirrors.

the World's Progress." Mr. Heitman let the chapter know some of the secrets concerning the private life of Mr. Johansson, and discussed the gage blocks in general. Assisted by Mr. J. R. Beane, of the Chester Branch of the Ford Motor Co. and J. J. Wydler from the National Supply Co. presented some interesting pictures and exhibits.

The following officers were elected for the coming year: Mr. John A. McMonagle, Chairman; Mr. Charles Crook, Jr., Vice Chairman; Mr. H. L. Simpson, Secretary; Mr. F. M. Crayton, Treasurer.

The chapter meeting was completed with seven exceptionally fine acts of floor show.

Philadelphia Chapter No. 15 wishes to extend good health and prosperity to Mr. David Lane, one of our charter members who recently was elected Vice President and General Manager of the Philadelphia Metal Stamping Co. Mr. Lane was formerly chief estimator of the Heintz Manufacturing Company.

Rochester

A fine description of the A.S.T.E. Emergency Educational Program covering the plant "up-training", plant training of operators, outside school training from operators to Tool Engineers, was given by Mr. Otto Winter, Chairman of the A.S.T.E. Educational Committee.

Mr. Winter addressed a joint meeting of the A.S.T.E. and the Superintendents and Production Managers group of the Industrial Management group of the Chamber of Commerce. About 175 were present to hear this talk covering the A.S.T.E. suggested plan for defense education.

Following Mr. Winter was Mr. Ralph Welch of the Chamber of Commerce, who is in charge of the Eastman Kodak. Camera Works' Employment Department and also is Chairman of the I.M.G. Training Committee. Mr. Welch revealed what was being done in Rochester in respect to emergency training. He told rather vividly what fine results were being secured from the University of Rochester, Mechanics Institute, Edison High School as well as the other Rochester high schools. Rochester is doing splendid work as proven by Mr. Welch's stated facts and figures.

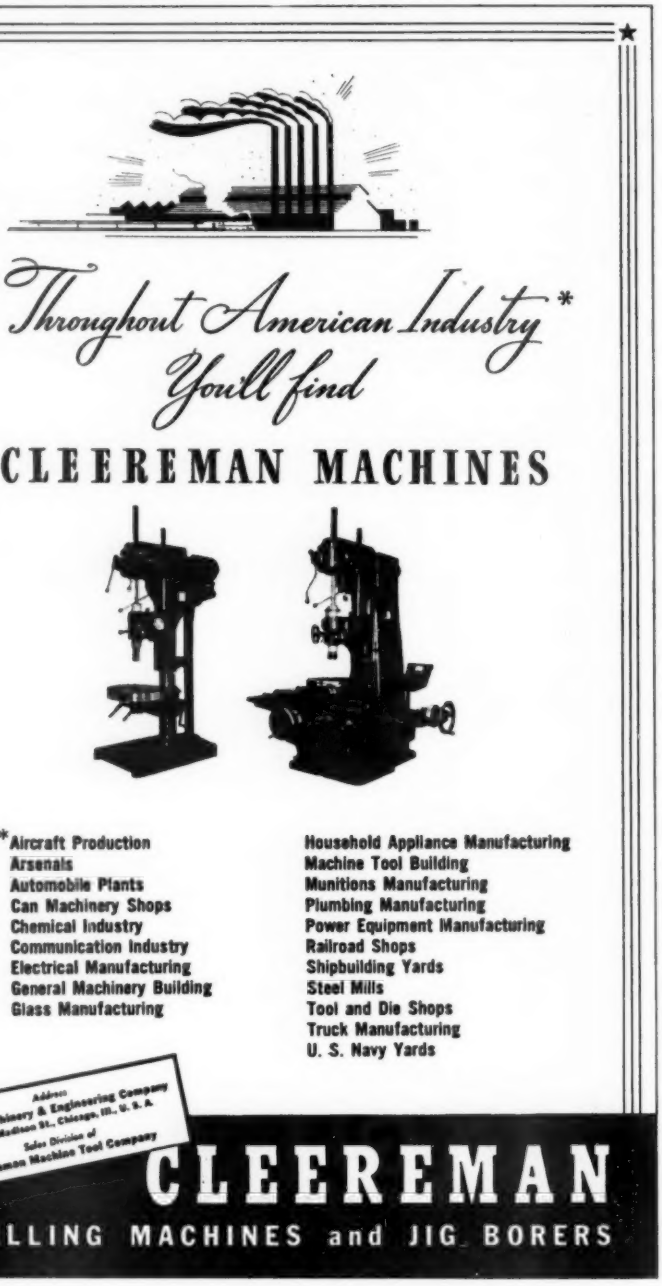
After the speakers had given way to the floor a number of interesting questions concerning factory problems as effected by the training of the men were raised for suggestions and answers. The interest on this subject was much greater than anticipated for although many of the listeners were not directly concerned with the problem, the splendid presentation as given by both speakers held the listeners' attention until the session broke up.

Mr. Ralph Ekberg of the Kodak Park opened the meeting by introducing Chairman John Dense who in turn introduced Mr. Winter and Mr. Welch. Dinner preceded the meeting in the Chamber of Commerce dining room and was attended by approximately 150.

Schenectady

The Danish Hall was again the meeting place for approximately 100 members of Schenectady Chapter on March 10, 1941. Following the usual good dinner, Fred Diehl, Chapter Chairman, introduced Mr. B. F. Waterman of the Brown & Sharpe Manufacturing Company who gave a very interesting talk in which he traced the historical development of gears and then touched on the theory of design, various methods of cutting, finishing, and testing.

In outlining the early application of gear mechanisms he reviewed the work of the French and English scientists in the 17th century who investigated the possibility of transmitting motion by use of 'notching wheels.' A significant fact in the development of gear design is that the mathematical calculations of these early scientists led them to the use



OSTER

MAKES PIPE *and* BOLT THREADERS • HAND SCREW MACHINES

A TOOL OR MACHINE *for* PRACTICALLY *Every* REQUIREMENT

WRITE FOR NEW 1941 CATALOG OR TELL US YOUR PROBLEMS
AND WE'LL GLADLY DISCUSS THEM WITH YOU

THE OSTER MANUFACTURING CO., 2063 E. 61st ST., *Cleveland, Ohio*

of a pressure angle which compares very closely to the 14½° angle in use today.

Mr. Waterman also pointed out that the basic principles of gear design have remained unchanged and are incorporated in the design of modern gear cutting machines and tools. Resulting from these developments, modern gears furnish an efficient and simplified means of transmitting power, at a constant speed ratio, making it possible to positively synchronize the movements of machine parts.

At the conclusion of his talk Mr. Waterman answered many questions concerning gear design, method of tooth measurement and other questions of a technical nature concerning hobs, worm wheels, helix angles and gear tooth forms.

Another dinner meeting is planned for April to be held at 'Endries' on the Saratoga Road. A prominent speaker will be secured to talk on the subject of 'Jigs and Fixtures.'

Springfield

Amidst the plaudits of 75 members who attended the first annual dinner and about 150 who attended the technical session of the Springfield, Massachusetts Chapter of the A.S.T.E. new officers were elected for the year 1941-42. This meeting wound up a year of activity, under the direction of its chairman Frank Curtis, which will be hard to duplicate.

As is the usual custom at the "Springfield Dinners" music and singing by all the "Lads" kept the enthusiasm running high.

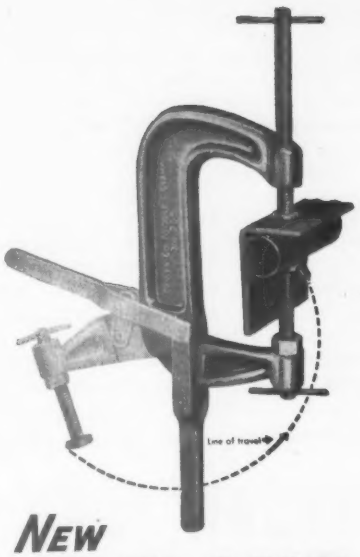
Election of officers immediately followed the dinner. The new officers are Mr. M. J. Brennan, Chairman; Mr. Sheldon, Vice Chairman; Mr. K. Miller, Treasurer; and Mr. Bill Suk, Secretary.

A talking moving picture presented by the Bureau of Mines on the evolution of the gas engine proved quite interesting. The main speaker of the evening Dr. E. J. Abbott of the Physicists Research Corp. presented a lecture on "Measuring Surface Finish". Dr. Abbott developed the instrument for measuring surface finishes known as the "Profilometer." The talk was ably presented and served to enlighten most of us on the problem encountered in measuring surface finishes.

After the technical session came the surprise which Messrs. Brennan and Suk had up their sleeves. This included the presentation of appropriate door prizes. Refreshments were also served. The meeting, no doubt, one of the best of the year, ended about midnight.

St. Louis

St. Louis Chapter held its regular monthly dinner meeting Thursday, March 13th, at the Elks Club. The meet-



NEW
"C" CLAMP
With Quick Acting
TOGGLE MOVEMENT

Combines all advantages of the old style "C" clamp plus swift toggle action. When released, entire lower half of clamp swings clear of the work.

Two adjustable rods permit holding work at exactly the desired spot. Will hold many types of work not possible with ordinary "C" clamps.

Now made in 6" size only. Withstands clamping pressure of over one thousand pounds.

TWO MODELS: — No. 255 as illustrated has screw type, threaded rods; No. 256 is exactly the same except holding rods are ½" standard, smooth rods, for use in arc welding where sparks might otherwise damage the threads on the screw type rods.

PRICES:—$5.00 per clamp, f.o.b. Detroit. Unless otherwise requested Clamp No. 255 (threaded holding rods) will be shipped. Write for price on lots of twelve or more clamps. Mail your order direct to:

DETROIT STAMPING CO.
Established Over 25 Years
356 Midland Ave • Detroit, Mich.

ing was presided over by Chairman D. D. Burnside, who during the business session, devoted most of his time and eloquence to convincing those present of the absolute necessity of attending the Exhibition in Detroit. The advance announcement that this was to be "Executive Night" evidently had lots of appeal, for it brought out 150 members and executives. The audience was well compensated for the time given to this meeting, because our own St. Louis executive, Mr. Hugh H. C. Weed, Vice President and General Manager of the Carter Carburetor Corporation, was the speaker, and what a speaker he is. His subject, which the writer prefers to name "The Human Side of Industry," was very well presented. His grasp of basic facts, so essential to a proper understanding between management and men in industry, was astounding. It is unfortunate that space does not permit setting forth the main points of his speech. The membership demonstrated by their applause that they want Mr. Weed to come back again.

Southern Connecticut

The Southern Connecticut Chapter was chartered March 18th, approximately 50 being present at the dinner and meeting held at Mellones Restaurant in New Haven. Somewhat over 30 applications were secured and as there are about 20 or 30 members in that district not affiliated with any chapter, this new chapter will start with a membership of about 50 to 60.

The following officers were elected: Chairman—Henry J. Bellemore, No. 39 Bassett St., New Haven, Conn.; Vice Chairman—Henry Chellis, c/o Chellis Company, Hamden, Conn.; Secretary—A. H. Hitchcock, High Standard Mfg. Co., New Haven, Conn.; Treasurer—Andrew P. Schoeffler, 45 Coran St., Hamden, Conn.

This new chapter will take in New Haven, Bridgeport, Stratford, Waterbury, Ansonia, etc., with good possibilities of being one of the strongest of the New England chapters.

Syracuse

Braving one of the worst storms of the season, twenty members of the Syracuse Chapter attended the dinner at the Syracuse Industrial Club on Tuesday, March 11. In the absence of the Chairman, Mr. Charles T. Allen, who was vacationing in Florida, Mr. A. H. Mitchell was appointed acting chairman.

Mr. Ray Adams gave a fine report on the activities of the committee in charge of arrangements for the Machine and Tool Show. He explained that there would be a special car leaving Syracuse, Wednesday, March 26, at 2:13 p.m., and urged everyone capable of attending the Show to do so. From the response shown at this meeting, Syracuse will be well represented in Detroit.

As speaker of the evening, Mr. Waterman of the Brown and Sharpe Mfg. Company, Providence, R. I., gave an illustrated lecture on "The History of Gearing and Gears." Inasmuch as Syracuse is a "gear town", this talk was very well received and the slides shown very interesting.

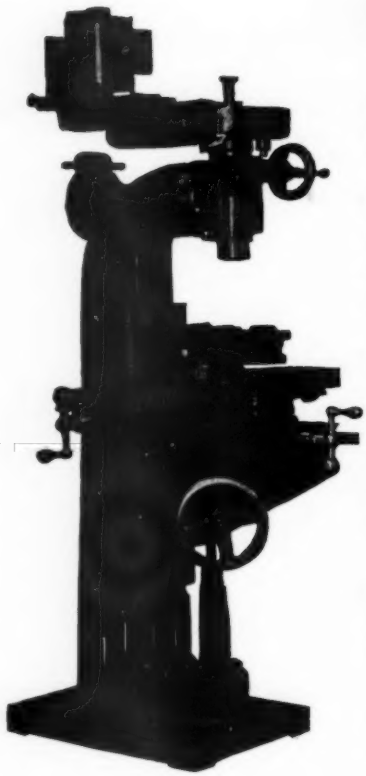
In order that members could get home in time to shovel out their driveways, the meeting was adjourned at the early hour of ten o'clock.

Toledo

The March meeting of the Toledo Chapter was held at the Toledo Yacht Club on Monday the 10th with thirty-seven attending.

Mr. Allen Owen of Owen & Owen, Patent Attorneys, of Toledo, was the speaker of the evening. His topic was "Relationship of Patents to Engineering Developments." It was alive and of such interest to the Toledo Tool Engineers that Mr. Owen, who had planned only

BREAK THAT BOTTLE NECK
in your tool room with a



40-H INDEX

at one third the cost you have in mind.

IT MILLS slots, keyways, cavities, irregular curves with end mills 1/8" to 3/4" diameter in tool steel.

IT DRILLS to accurate locations without layout.

IT BORES up to 3" holes in steel—vertical, horizontal or at angles.

HAS VERNIERS for locating 8"x16" at one setting.

Owing to increased plant capacity, we are now able to make very good deliveries.

Write for details and quotation.

Blank & Buxton Machinery Co.
3000 E. Michigan Avenue, Jackson, Michigan

DRAFTED

Not shirking today's tough defense assignment! Eclipse counterbores never look for a soft job! In depression, when every economy is considered or under today's backlog pressure when cost plays second fiddle to efficiency—you'll find Eclipse Radial Drive counterbores at work for wise shopmen!

ECLIPSE COUNTERBORE CO.
DETROIT · MICHIGAN

CHICAGO MOUNTED WHEELS OF V/T SUPER BOND

150% LONGER LIFE

Rigid tests on snagging and exacting operations prove they have 150% to 300% longer life. Won't ridge on welds, sharp corners, sinking dies, barbering, etc.

There's a shape and size to handle every grinding job faster, better, at lower cost.

V/T Super Bond is the most important development in mounted wheels in 30 years.

Send for a trial Wheel. Tell us the kind of job, type of equipment you use and size wheel you prefer.

FREE MOUNTED WHEEL CHART—Ideal for ready shop reference. Size 22" x 15". Shows actual size and shape of every standard Chicago Mounted Wheel.

Handee Tool of 1001 Uses

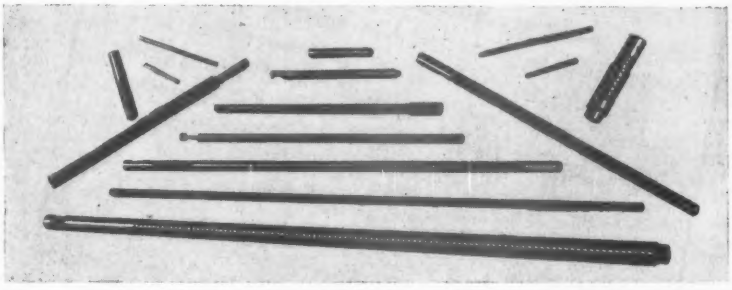
Grinds, drills, polishes, cuts, routs, carves, sands, saws, sharpens, engraves, cleans, etc. Uses 300 accessories. 25,000 r.p.m. Wt. 12 oz. $18.50 with 7 Accessories.

Send for catalog of complete line.

CHICAGO WHEEL & MFG. CO.
Makers of Quality Products for 40 Years
1101 W. Monroe St., Dept. TE. Chicago, Ill.

10 days Free Trial

AMERICAN
BROACHES FOR
DEFENSE *Production*



Today's production schedules amplify the value of dependable broaching tools. Present defense demands make no allowance for "shut-downs" and broaching tools must be able to "stand the gaff." AMERICAN has successfully tooled up many broaching jobs for defense production. This is why we say, "Broach with AMERICAN at a saving."

AMERICAN BROACH & MACHINE CO.
ANN ARBOR, MICHIGAN, U.S.A.

a brief talk so as to enable him to attend the Golden Gloves Tournament held in Toledo the same evening, wasted a good ringside seat, for the questions from the gang at the Yacht Club in the discussion following his talk held him in attendance at our meeting until long after the fights were over.

Mr. Owen ordinarily would have collected substantial retainer fees for the advice on patents passed out at this meeting, but his sole recompense was an entertaining evening of good fellowship.

Twin States

The Twin States Chapter was chartered in Springfield, Vermont, Friday night of last week, the following officers being elected: Chairman—Wilbur Handy, c/o Fellows Gear Shaper Co., Springfield, Vt.; 1st Vice Chairman—Merton Arms; 2nd Vice Chairman—John Lawrence; Secretary — Milan Jennings; Treasurer—Hartness Beardsley.

Approximately 80 men attended the dinner and meeting held at the Masonic Hall, Springfield, Vt., representatives of all the New England Chapters being present. Sixty-five signed applications were received at the charter meeting and eight more in that area who have been members of other chapters have affiliated with the Twin States Chapter, giving them a start of 73 members.

The membership of this new chapter is made up of plant executives, Tool Engineers, tool designers, chief inspectors, etc., many of these men having anywhere from 15 to 25 years shop training.

30th ★ 1911 Anniversary
Atlas
DEFENSE LESSON NO.1
Production speed-up formula: Coordinate equipment and operations. Use large tools for machining large parts. Use smaller, inexpensive equipment to the limit of its capacity on small parts. Atlas Machine Tools are demonstrating their absolute dependability on small part production in hundreds of plants.
When the nation returns to a peace time economy, Atlas production savings will help many plants open up the new markets that will be so vitally needed.
ATLAS PRESS COMPANY
414 N. Pitcher St.
Kalamazoo, Mich.
Atlas
ATLAS PRESS CO.
KALAMAZOO, MICH.
U. S. A.

Western Michigan

The Western Michigan Chapter No. 38 held its regular meeting Wednesday March 12 in the Browning Hotel, Grand Rapids. The supper meeting, was attended by 75 members and their guests. Several reports were heard on the 1941 Machine Tool Progress Exhibition, and considerable interest is being displayed, which should bring a 100% attendance at the exhibition. Mr. Randall, who acted as toastmaster, introduced the speaker of the evening, Mr. F. O. Hoagland, Master Mechanic of the Pratt & Whitney Company, Tool Division. His subject was the evolution of the machine tool. His talk, which was illustrated by slides, was very well received, and left no doubt that the machine tool industry has progressed to a great degree, not only in accuracy, but also in production ability.

The educational committee also presented Mr. Fraaze, educational director for National Defense Industrial Training. His talk was based on what is being done in regard to training men for industry, and the benefits from committees, such as the A.S.T.E. Education Committee.

Worcester

The March meeting of the Worcester Chapter was held Monday, March 10th at Putnam & Thurston's. It was a joint meeting with the Worcester Chapter of the American Society for Metals. Newly appointed committee chairmen for the year were introduced. They are: Meetings Committee, Leslie Goff; Entertainment, H. W. Wilder; Publicity, M. B. Whiting; Membership, F. H. Harris; Editorial, Victor Ericson; Industrial Relations, George Grover; Standards, C. H. Bigwood; Constitution & By-laws, Robert Lippard; Educational, H. G. Libby. George Bickford and Thomas Bradford were appointed members at large.

The technical session began at 8:30 P.M. The speaker was Mr. Norman I. Stotz, Chief Metallurgist of the Universal-Cyclops Steel Corporation. He gave a very interesting discussion on Tool Steels. A general discussion from the floor followed the talk and many seized the opportunity to ask their pet puzzlers.

THE Passing Parade

Lou R. O'Connor has been appointed Seattle, Washington representative of Ampco Metal, Inc., Milwaukee. Clinton E. Swift has joined the Weldrod Division of the company and will head development, production, and distribution of Ampco-trode.

R. O. Anderson has been transferred to Worcester where he will assist W. R. Moore, General Sales Manager, of the Norton Company. C. B. Price becomes District Manager in Pittsburgh, replacing Mr. Anderson.

Raymond E. Christie, a prominent figure in the stainless steel industry, has

Crucible's Christie
Elected vice-president and director.

been elected a vice president and director of the Crucible Steel Company of America. Mr. Christie was previously assistant to the President.

E. B. Nisbet, formerly Purchasing Agent and Treasurer of the Laminated Shim Company, has become Executive vice president. E. R. Young becomes vice president in charge of production, and Richard Seipt becomes vice president in charge of sales of the same company.

Bonnell W. Clark, R. A. McCarty, Frank D. Newbury, and A. C. Streamer have all been made vice presidents of Westinghouse. Mr. Clark is now president of the Westinghouse Electric Supply Company; Mr. Newbury, manager

(Continued on following page)

Rotary Power Tools

TEETH DESIGNED TO PRODUCE SHEARING CUTS AND FLUTES THAT THROW OUT THE CHIPS

"Ground from the Solid After Hardening" for keenness—speed—and for durability which permits regrinding at low cost, Severance Cutter Tools, in various sizes and shapes for the Hard Metal, Wood and Plastic Industries, are known as Midget Milling Cutters—Rod or Tube Deburring Cutters, for inside or outside diameters or in combination—Chatterless Seating and Facing Cutters —Chatterless Countersinks—Reamers and Electrode Dresser Cutters. All made from High Speed Steel. Special Cutters considered upon request.

General information upon request — and engineering service or a confidential treatment of your problem available without obligation.

Main Offices at 1522 East Genessee Avenue, Saginaw, Michigan

SEVERANCE TOOL COMPANY

ADJUSTABLE HOLE PUNCHING AND NOTCHING DIES

KEEP THAT PRESS IN OPERATION CONSTANTLY with WALES DIES

when punching holes and cutting notches in flat sheet metal parts. Change from one operation to the next or from one part to another

WITH NO LOST TIME

Slide one set-up out of the press and another in and keep on working.

Nothing attached to the ram of the press.

We make all kinds of dies for punching and notching sheet metal, angle iron and shapes and are

SPECIALISTS IN PUNCHING AND NOTCHING EQUIPMENT

WRITE FOR CATALOG

THE STRIPPIT CORPORATION

1200 Niagara Street BUFFALO, N. Y.

(Continued from preceding page)

of the Emergency Products Division; Mr. McCarty, manager of the Steam Division; and Mr. Streamer, general manager of the East Pittsburgh Division.

Hugh E. Replogle has joined the organization of the Universal-Cyclops Steel Corporation in a general tool steel sales capacity. His headquarters will be at Titusville, Pa.

Colonel Carl M. Tichenor has been appointed executive vice president and general manager of the Doyle Machine & Tool Corporation of Syracuse. He is one of America's pioneers in the Aviation industry, his early developments dating back to 1907, about the time of the first successful flights by the Wright Brothers. During the last war he was Chief of Aircraft Engine Inspection for the government, and later Chief of Aircraft Armament Production.

J. B. Cole has been added to the sales staff of the Tool Equipment Sales Company of Chicago. This company has just been appointed exclusive representative in the Chicago territory for the Lempco Products Company, a new entrant into the machine tool field with grinding machines and arbor and straightening presses.

Arthur C. Allshul, manager of the Philadelphia plant of Joseph T. Ryerson & Son, Inc., retired recently after 42 years of service with the company. At the time of his retirement, Mr. Allshul had the longest continuous service record of anyone in the company.

E. J. McPhee has been appointed general superintendent of the Dodge Truck Division, Chrysler Corporation. He has been superintendent of assembly since production of Dodge trucks was started in the Mound Road plant in September, 1938.

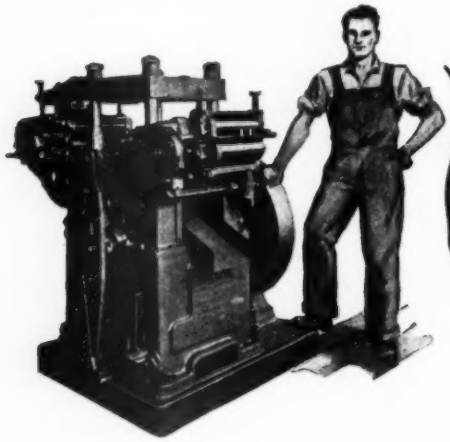
Dodge Truck's McPhee
The new general superintendent.

C. F. Bennett was advanced from president to chairman of the board and R. E. Pritchard was elected president March 17 by directors and stockholders of the Stanley Works, New Britain, Conn.

Aldus C. Higgins, chairman of the board of directors of the Norton Co., Worcester, Mass., and a member of the board of directors of the National Association of Manufacturers for 1941 has been named a member of the N.A.M.'s employment relations committee and national industrial information committee.

American Bosch Corporation, Springfield, Mass., has appointed Thomas J. Kiely, sales manager of the aviation di-

(Continued on page 154)



Dieing Machine users enjoy record-making high production and record-making low costs!

This Unique machine reduces stamping costs 60% to 90%, maintaining product accuracy to .0002", and producing 1 to 20 COMPLETED parts per stroke at speeds up to 600 s.p.m. In a class by itself for smooth operation at high production rates, one Dieing Machine does the work of 5 to 10 conventional presses, with die life increased 600% to 1200%. Capacities: 10 tons to 300 tons. Request Catalog 41.

THE HENRY & WRIGHT MFG. CO.
HARTFORD, CONN.

Producing intricate parts COMPLETE PER STROKE

Airplane strut seat of .031" brass produced one complete per stroke, 140 strokes per minute.

A variety of machine gun belt links are produced one complete per stroke at rates as high as 140 completed links per minute.

HENRY & WRIGHT DIEING MACHINES

SHELDON BACK GEARED SCREW CUTTING *Precision Lathes*

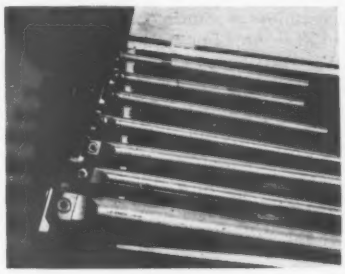
Meet new production demands with new 11" and 12" Sheldon Precision Lathes. Though moderate in price, they are quality machine tools, precision tools with modern features.

The U-1236 WQ (illustrated) comes with 4-speed anti-friction lever-operated, Pedestal Motor Drive. Full Quick Change Gear Box; Large Special Analysis Steel Spindles that are ground *all-over*, inside and out—even the spindle nose thread is ground; Precision Preloaded Ball or Roller Spindle Bearings, Double Walled Worm Feed Apron with Power Cross Feed and other quality features. Sheldon lathe beds are semi-steel with hand scraped ways, 2 V-ways and 2 flat ways.

Write for Catalog

SHELDON MACHINE CO. INC.
1619 N. Kilbourn Ave. Chicago, U.S.A.

EVEREDE BORING BARS



Number 3 Set

These are the only boring bars on the market having the economical triangular bit, permitting the use of a larger bar diameter as the bit cuts ahead of the bar. This new design insures rigidity, making higher boring speeds and heavier cuts possible.

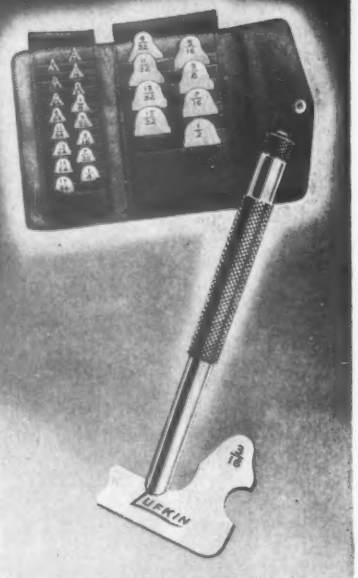
Everede Boring Bars are made of the finest heat treated nickel steel and each bar is furnished with six triangular high speed steel bits.

The Everede Boring Bar also permits the use of a solid stellite or carbide tool bit by clamping the bit in the "V" Type grip holding it firmly without danger of breakage.

Write for descriptive folder.

EVEREDE TOOL CO.
WILLIS STUTSON
184 N. Wacker Drive Chicago
Representatives in principal cities

LUFKIN RADIUS GAGES



EASY TO USE 5 APPLICATIONS

Because each blade in the Lufkin set of Radius Gages is a separate unit, it is more easily and accurately applied to the work. No other parts of the set can cause interference. Each blade has five applications for its individual radius and carries the corresponding external and internal forms. An attractive, durable leatherette folder is supplied with each set to not only protect the gages, but to make the selection of them simple and easy. And for hard-to-get-at places, use the Lufkin Gage Holder which is furnished at a slight additional cost.

BUY THROUGH YOUR DISTRIBUTOR

LUFKIN
SAGINAW, MICHIGAN • New York City
TAPES - RULES - PRECISION TOOLS

PERECO ELECTRIC FORGE FURNACES

for tool hardening and general heat treating.

★ Pereco Electric forges are designed for all types of shop work. They are adapted for open, closed or partially closed hearth work; or furnished with counter-balanced door. All are equipped with long-life, non-metallic elements (GLOBAR Type).

AVAILABLE IN FLOOR OR BENCH MODELS

The floor model is designed for temperatures to 2700 F. and provides working space of 4" x 8" x 10". The bench model is for temperatures to 2200 F. and provides working space 5" x 5" x 10". Refractory plugs for all openings are furnished with both models.

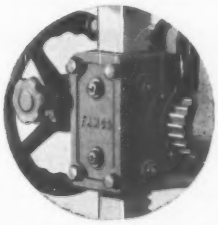
• *Send For PERECO CATALOG No. 41-L*

PERENY
POTTERY & EQUIPMENT CO.
842 N. Pearl St. • Columbus, Ohio

FAMCO ARBOR PRESSES and FOOT PRESSES

Floor and Bench Models

A STOCK SIZE FOR MOST EVERY NEED



Front and side Gib adjustments Exclusive with FAMCO

Write for catalog

FAMCO MACHINE CO.
1326 18th St. RACINE, WIS.

(Continued from page 152)

vision. Mr. Kiely has been associated with American Bosch since 1923, for most of this period in the engineering department.

Theron L. Loose has resigned as general manager, treasurer and director of Harrington Richardson Arms Co., Worcester, Mass. Mr. Loose, who came from Springfield to become manager at the behest of a creditors' committee in 1938, said he would take a month's rest before considering offers. Reorganization of the arms company, under his direction, was recently completed.

William E. Lawrence has retired from the employ of Smith & Wesson Company, Springfield, Mass., after serving that organization for 41 years in the tool and gauge department. He was given a testimonial dinner at Hotel Highland. More than 60 fellow employes and officials of the company were present.

Clarence B. Nickerson has been named controller of the Greenfield Tap & Die Corporation by the directors, succeeding John B. Roys, who remains as secretary and also assistant controller. The directors named Donald G. Millar, as vice president and Clarence C. Ziegler as head of the sales department. Vacancies on the board caused by the resignations of Col. Frederick H. Payne and Francis E. Smith were not filled.

R. L. Hamilton has been elected vice president of the Dumore Company of Racine, Wisconsin. He has been with

Dumore's Hamilton
Active in Electric Tool Institute

the company since his graduation from the University of Notre Dame in 1934. He is a member of the Board of Controls of the Electric Tool Institute.

William W. Britton has been made special representative for the Pacific Coast territory for the Jessop Steel Com-

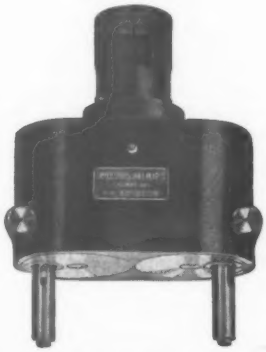
Jessop's Britton
Crossed the continent.

pany of Washington, Pa. A graduate of the University of Alabama, he was previously located in Dayton, Ohio.

(Continued on page 156)

SPEED CASE STEEL
A LOW CARBON OPEN HEARTH PRODUCT
Assures You . . .
1. MACHINABILITY
Machines as fast and free as SAE X1112 Bessemer Screw Steel with long tool life and smooth finish on completed parts.
2. CARBURIZING
Carburizes like SAE X1020
3. PHYSICAL PROPERTIES
Equal to SAE X1020-X1315-1115
4. UNUSUAL DUCTILITY
180° Bend (Cold Drawn - 1" Rd)
5. SMALLER INVENTORY
Due to Versatility of Speed Case
6. INCREASED PRODUCTION
40% to 80% Over SAE X1020-X1314, etc.
JOBBERS NOTE!
Reduce Your Inventory
SPEED CASE
the ALL PURPOSE Steel
will allow you to reduce the number of different steels you are now carrying in your stock.
ASK US FOR DETAILS
Licensor
MONARCH STEEL COMPANY
HAMMOND • INDIANAPOLIS • CHICAGO
PECKOVER'S LTD. Toronto, Canadian Distributor
Licensee for Eastern States
THE FITZSIMONS COMPANY
YOUNGSTOWN, OHIO
MANUFACTURERS OF COLD DRAWN CARBON AND ALLOY STEEL BARS

U S
HEADS
STANDARD SINCE 1915



30 DIFFERENT STANDARD SIZE ADJUSTABLE DRILL HEADS, CAPACITIES UP TO 1 3/4" DRILLS

SEND US YOUR B/PS

All Types of Fixed Center Heads

UNITED STATES DRILL HEAD CO.
Cincinnati, Ohio

5000 SHAPES and SIZES

GROBET SWISS FILES

WRITE FOR CATALOG 2F

The most complete catalog of its kind. Lists 5000 different shapes, sizes and cuts of GROBET Precision Swiss files. Learn more about these Chrome Steel Files that have won a reputation for utmost precision and durability.

Ask also for catalog YM on Files for Filing Machines; catalog YR on Rotary Files and Diesinker's Burs.

GROBET FILE CORP. of AMERICA
3 PARK PLACE NEW YORK, N. Y.

IVES ENGINEERING LABORATORIES
ESTABLISHED 1922

Saved!!!
$100,000 Annually

A recent survey by us made this possible for a large Chicago concern.

Much equipment is semi-obsolete today.

We are in position to help modernize for today's tempo.

Inquiries solicited.

LABORATORIES ENGINEERING IVES
216 N. Clinton Street CHICAGO

TO INSTRUCT NEW MEN in the handling of DIAMOND TOOLS

we will send you a valuable booklet. No charge, no obligation.

KOEBEL DIAMOND TOOL CO.
9348 Grinnell Ave., Detroit

KOEBELITE DIAMOND TOOLS

Multi-Point, Multi-Set, Multi-Edge, and Single Set. Diamonds for all Industrial Purposes.

T. H. L. FRONT LEVER
BENCH PUNCH

PRICE WITH ONE PUNCH AND ONE DIE—

$40.00

Immediate Shipment

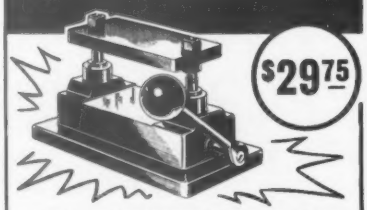
Built for hard, tough work—die cannot lose alignment with punch—all parts interchangeable.

Capacity 1/2" holes through 3/16" steel; 13/32" through 1/4" steel. Can also be made for holes up to 7/8" in thinner metal. Stock punches and dies available from 1/16" to 1/2" by 64ths.

Weight, 70 lbs.

T. H. LEWTHWAITE MACHINE CO.
(Est. 1890)
307 E. 47 St. NEW YORK

CUTS TOOLING TIME
SPEEDS PRODUCTION



$29.75

THE UNIVERSAL VISE

Gives you a ready-designed drill jig body that greatly reduces the tooling time and helps you get into production faster. You'll be amazed at its loading and unloading speed. Positive, quick action lever locks work instantly — holds securely — throw it back and work is released. No complicated adjustments. No costly drill fixtures needed — just a comparatively inexpensive drill bushing plate and adaptor for each job. Sturdily constructed thruout — nothing to get out of order. Pays for itself many times over. Only $29.75 f.o.b. Chicago.

Sold on a MONEY BACK Guarantee ORDER TODAY

MOHR LINO-SAW COMPANY
122 N. Union Ave., Chicago

(Continued from page 154)

E. F. Hennessey has been named vice president of Stevens-Walden Inc., Worcester, Mass., automotive tool manufacturers. Mr. Hennessey comes from Springfield where he was engaged in the sales development field.

The division of production office of Production Management announced appointment of L. E. Osborne, Grosse Point, Mich., manager of the engineering manufacturing and merchandising division of Westinghouse Electric and Manufacturing Company in charge of the Springfield, Mass. and Mansfield, O. Westinghouse plants, to be chief of the artillery, fire control and optical unit of the ordnance section.

R. H. Hathaway formerly sales engineer for the Production Machinery Co. of Greenfield, Mass. has been named assistant to the chief engineer of Hammond Machinery Builders, Inc., Kalamazoo, Mich. Mr. Hathaway gained his technical experience in the polishing and abrasive equipment field.

Died

C. E. Nelson, 63, supervisor of tools at the Jeffrey Manufacturing Co., and vice chairman of the Columbus Chapter of the A.S.T.E., on March 19 of a heart attack, following an illness of two weeks.

Alphonso S. Campbell, 63, while enroute to Rio de Janeiro. He was president of the Campbell Company of Boston, one of the largest metal stamping concerns in the East.

Lewis E. Saunders, 67, a vice president since 1937 of Norton Company, Worcester, Mass., of a heart attack, following an illness of two weeks.

Robert Williamson, 54, founder and treasurer of Superior Tool and Manufacturing Company.

Plastics Tested For Aircraft Use

Following a plea by E. R. Stettinius. Jr., Priorities Director of the Office of Production Management, to industry in which he asked that attention be directed to the use of plastics to conserve metals vital to defense, it was revealed that tests are already under way of substitutes for metals used in aircraft manufacture.

These tests are intended to perfect plastics which can be used to replace metals such as aluminum in cowl covers, engine baffles, and flooring.

The Bureau of Standards has in hand a project to develop a new plastic which can be used in aircraft for structural units subject to stess as well as the unstressed parts.

Mr. Stettinius said: "With defense industries making compelling demands on the available supply of such metals, it appears that the supply available for other production in the non-defense sphere will be diminished.

"This means, in turn, that the whole question of plastics now becomes more important than ever before. A number of industries through their trade associations have already launched investigations to see how and to what extent they can expand the use of plastics in their products. We feel that manufacturers who have not yet done so should make similar efforts."

With the

EMPCO HONING MACHINE

- **DIMENSIONAL ACCURACY IS MAINTAINED FULL LENGTH OF BORES**
- **OPERATIONS ARE PERFORMED WITH SPEED AND ECONOMY**

Full operating control, automatic or manual.

Standard Machine has diameter capacity range of 2 to 12 inches and length capacity to 60 inches.

Both conventional and co-directional honing are provided.

The Empco can be quickly changed from one job to another.

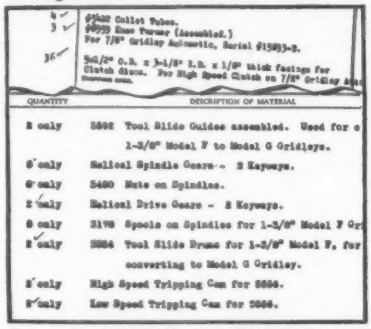
Streamlined in design, rugged in construction, simple in operation, speedy in production, accurate in performance, the Empco represents the last word in honing efficiency.

Write for illustrated and descriptive circular.

EMPCO

ENTERPRISE
MACHINE PARTS CORPORATION
2733 JEROME AVENUE • DETROIT, MICHIGAN

Accepted As A Most Dependable Source



QUANTITY	DESCRIPTION OF MATERIAL
2 only	5502 Tool Slide Guides assembled. Used for c 1-3/8" Model F to Model G Gridleys.
6 only	Helical Spindle Gears - 2 Keyways.
6 only	5480 Nuts on Spindles.
2 only	Helical Drive Gears - 2 Keyways.
8 only	3178 Spools on Spindles for 1-3/8" Model F Gr
2 only	5504 Tool Slide Drums for 1-3/8" Model F, for converting to Model G Gridley.
2 only	High Speed Tripping Cam for 5504.
2 only	Low Speed Tripping Cam for 5504.

for A WIDE VARIETY OF SCREW MACHINE REPAIR PARTS

Purchase orders listing innumerable screw machine repair parts are now received regularly by Modern Collet.

When a machine is rebuilt or modernized in our plant, any one of dozens of parts require replacement. For that reason, facilities have been provided to have these parts on hand whenever they are required—either for rebuilding purposes or to be sold as individual replacement parts. Each is of the best quality and most advanced design—always equalling or excelling the specifications of the part which is replaced.

The next time you require any screw machine part—regardless of whether or not it is of the "hard-to-find" variety—take advantage of the convenience and economy of Modern Collet's service. See your Modern Collet representative or write directly to the factory.

MODERN COLLET and MACHINE CO.
411 Sailiotte St. Ecorse, Michigan

Do you need cutters, reamers, drills, to carry on your work? And are you having trouble getting them?

It is a safe bet that you have plenty of discarded ones which we could put right back on your arbors and spindles if you would give our man a chance to show you.

NATIONAL TOOL SALVAGE CO.
3816 Beaubien Street
Detroit, Mich.

RUTHMAN
GUSHER
COOLANT PUMPS

CUP DISC FAN PROTECTS MOTOR

A patented cup disc fan built into the upper part of the motor prevents oil or dirt from getting on the motor windings—just another reason why you can expect long and efficient service from Ruthman Gusher Coolant Pumps.

Model No. 11020A

Model No. 11622 Patented and Patents Pending

Gushers can be throttled to any speed without building up pressure, and they can handle cutting fluids containing grit without danger of injury. Write for complete data sheets.

THE RUTHMAN MACHINERY CO.
542 E. FRONT ST., CINCINNATI, OHIO
LARGEST EXCLUSIVE BUILDERS OF COOLANT PUMPS

GARRISON
GEAR CHUCKS

are used on—

- GEAR SHAPERS
- DRILL PRESSES
- ENGINE LATHES
- TURRET LATHES
- INTERNAL GRINDERS
- EXTERNAL GRINDERS
- OSCILLATING GRINDERS
- DIAMOND BORING MACHINES
- HORIZONTAL BORING MILLS

and are used for—

Grinding . . . Precision Boring . . . Machining and other operations on Spur . . . Internal . . . Bevel . . . Cluster . . . Helical and Herringbone Gears.

GARRISON
MACHINE WORKS, INC.
DAYTON OHIO

THREAD GAGES

PRECISION THREAD GRINDING

Complete Engineering Service

« « Consulting » »

I.T. WEDIN & CO.
22337 Woodward Ave.
FERNDALE (Detroit) MICH.

BALDOR
BALL BEARING GRINDERS

for accurately sharpening

CARBIDE TOOLS

1-YEAR GUARANTEE

BALDOR CARBIDE TOOL GRINDER is precision-built for accurately and quickly sharpening Carbide Tools. Sturdy ½ H.P. heavy duty, ball-bearing, reversible Motor. Large adjustable tool-rest tables. Satisfaction guaranteed. Price, complete with wheels and accessories. **$95.00**

WRITE FOR BULLETIN 83
BALDOR ELECTRIC COMPANY
4355 Duncan Ave. St. Louis, Mo.

BUILT BY MOTOR SPECIALISTS

April Meetings

BOSTON—April 10. River Works of General Electric Co., Lynn, Mass. Plant trip 3:00 P.M. Dinner 6:30 P.M. Technical session 7:45 P.M. Mr. W. G. Robbins, President of the Carboloy Company will speak on the subject, "Recent Developments in Tungsten Carbide." The plant visitation will take in those departments using tungsten carbide and members and guests will have an opportunity of seeing Carboloy at work.

CLEVELAND—April 11. 6:30 P.M. Hotel Allerton, Chester Ave. & East 13th St. Mr. Myron S. Curtis will speak on the subject, "Recent developments in equipment for the machine operations on the high explosive shells." Illustrated with slides. Reservation: Wm. Reiff, Jr. Main 0112.

HARTFORD—April 7. 6:00 P.M. Hartford Gas Auditorium, Pearl Street, Hartford, Connecticut. Mr. Malcolm F. Judkins, Chief Engineer, of the Firth-Sterling Steel Company will talk on the subject, "Cemented Carbides." Reservation: Mr. Albert E. Englund, Jacobs Mfg. Co., Hartford, Conn.

NEW YORK-NEW JERSEY—April 8. 8:00 P.M. Alexander Hamilton Hotel, Market & Church Sts., Paterson, New Jersey. Mr. H. B. Cook of the Wright Aeronautical Corp. will speak on the subject, "Tooling the Wright Cyclone Double Row Crankshaft." Motion pictures of the Wright Plant in operation.

PEORIA—April 1. 6:30 P.M. Mr. Ernest V. Flanders of the Jones and Lamson Machine Co. will speak on "Modern Developments of Thread Grinding." Reservation: Mr. Everett C. Bowton, 412 Thrush Ave., Phone 2-6984.

PHILADELPHIA—April 17. 6:30 P.M. Engineer's Club, 1315 Spruce Street. Coffee speaker will be Willis T. Spivey, Regional Director of Eng. Defense Training. A representative of the Continental Machines, Inc. will speak on "Continental Process."

ROCKFORD—April 3. 6:00 P.M. Hotel Faust, Rockford, Illinois. Joint meeting with the Rockford Gas Bugs. Mr. W. M. Petrie of Chrysler Corporation will speak on "Superfinish, Aircraft from Engine to Fuselage." Inspection trip of West & Southwest Aircraft Industry. Dinner speaker will be from the United Air Lines. Reservation: Allis Chalmers, Main 6270.

ST. LOUIS—April 10. 6:30 P.M. Melbourne Hotel, Grand & Lindell.

SOUTH BEND—April 10. Dinner 7:00 P.M. Technical Session 8:00 P.M. Elkhart Hotel. Mr. E. W. P. Smith, Consulting Engineer of the Lincoln Electric Co., will speak on the subject, "Welded Jigs & Fixtures."

SPRINGFIELD—April 28. Dinner 6:30 P.M. Meeting 7:45 P.M. Hotel Bridgway. Mr. E. V. Crane, Consulting Engineer of the E. W. Bliss Company, will speak on "Practical Die Design." The talk will be fully illustrated with slides and motion pictures. Reservations: Mr. Wm. J. Suk, Jr., 95 State St., Springfield, Mass., Phone 3-8362.

SYRACUSE—April 15. Dinner 6:30 P.M. Meeting 8:00 P.M. Syracuse Industrial Club. Mr. Frank W. Curtis, Chief Engineer of the Van Norman Machine Tool Co. will talk on "Jig and Jig Fixture Design."

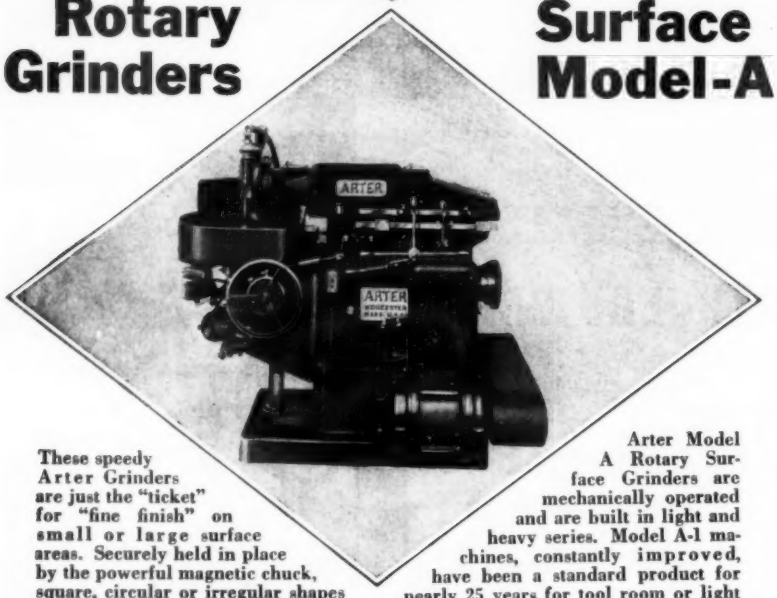
TOLEDO—April 14. Dinner 6:30 P.M. Hotel Hilcrest. Toastmaster will be Mr. C. E. Swartzbaugh, President of the Swartzbaugh Mfg. Co. Acting Adjutant General Rolland Lee, U. S. Army will talk on "Defense." Reservation: R. H. Mogle, 3722 Leybourne, La. 8783.

TRI-CITIES—April 2. 6:30 P.M. LeClaire Hotel, Moline, Illinois. Mr. Ernest Flanders of Jones & Lamson will speak on the subject, "Thread Grinding."

ARTER

Rotary Grinders

Surface Model-A



These speedy Arter Grinders are just the "ticket" for "fine finish" on small or large surface areas. Securely held in place by the powerful magnetic chuck, square, circular or irregular shapes are precision ground. In addition to their great swing capacity, they have an unusual vertical capacity. Arter accuracy is assured by the one piece casting of the bed, the sturdy wheel slide and knee. These features mean sustained accuracy and low maintenance.

Let us tell you why Arter Machines mean lasting precision, greater versatility and higher capacity on your production grinding jobs.

Arter Model A Rotary Surface Grinders are mechanically operated and are built in light and heavy series. Model A-1 machines, constantly improved, have been a standard product for nearly 25 years for tool room or light production work.

Model A-3 machines, of heavier proportions, have been progressively developed over a period of years to meet the modern demands for close limit work on volume production.

Model A-1 machines are offered in 8" and 12" sizes, A-3 machines in 12" and 16" sizes. For grinding larger diameters Arter offers Model B machines. These are hydraulically operated and made in diametrical capacities of 20"-24"-30"-40".

ARTER GRINDING MACHINE CO.

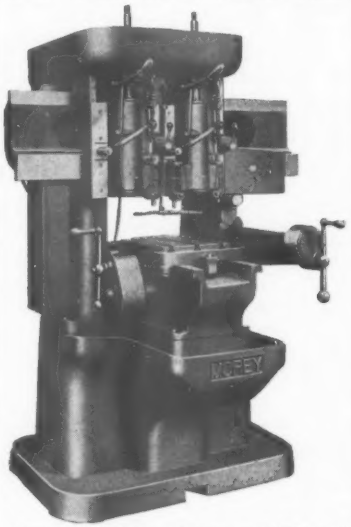
WORCESTER MASSACHUSETTS

The Tool Engineer Adopts New Standard Size

Readers of THE TOOL ENGINEER will note that this issue has a larger page size than previous issues. This month the trim size has been increased to comply with the standards of the industry in the hope of standardizing business publications.

At the same time a larger, more readable type face has been adopted for the feature articles. These changes are part of a long-range program for making THE TOOL ENGINEER of increasing value to its readers.

MOREY No. 12M High Speed Vertical PROFILER and MILLING MACHINE



Many new features speed up manufacture of small parts—increase accuracy. Unique table design gives twelve inch maximum working space.

INVESTIGATE!

Write for Bulletin 12M

MOREY MACHINERY CO., Inc.
410 Broome Street, New York, N. Y.

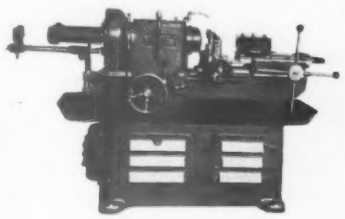
Winter Will Head A. S. T. E. Defense Training Committee

Otto W. Winter, well known in Tool Engineering circles, has been appointed Chairman of the Emergency Defense Training Committee by the American Society of Tool Engineers. This committee functions with the National Education Committee, established a few months ago to determine the needs of industry for skilled men and to develop the necessary plans for their education. Details concerning the program of the Educational committee were recently given out.

Responsible for determining the requirements of industry for skilled men in various localities, progress has already been made toward cooperating with current training activities and in promoting additional activities where found necessary. The committee also functions in a technical advisory capacity.

The Committee is composed of representatives from each Chapter of the A.S.T.E., 40 of which are located throughout the country. Regional Staff Members also are located in each state, with whom members in communities where no chapter exists will advise and cooperate.

Investigate
MOREY No. 2G TURRET LATHE



Range 90 to 1800 R.P.M. or 180 to 3600 R.P.M.

Designed for high-speed turning on small diameters using Tungsten Carbide and diamond tools. 1" wire feed capacity — 6½" turning length. Motor drive.

Ask for descriptive bulletin.

MOREY
MACHINERY CO., Inc.
410 BROOME ST., NEW YORK

A LaSalle Design

Would you like to hire this staff?

88 yrs. college training
4 former chief tool designers
3 former mechanical superintendents
1 former chief engineer
1 electrical and mechanical engineer

Call on us for Tool Designing.

LA SALLE DESIGNING CO.
628 W. LAKE ST.
CHICAGO, ILLINOIS
Monroe 2345

BETTER Your BORES By BEARINGIZING SECURE ULTRA-SURFACE & ACCURACY with MINIMUM COST

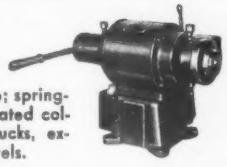
INTERNAL, EXTERNAL & CONTOURS

SEND DRAWING FOR RECOMMENDATIONS

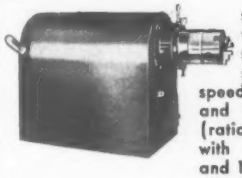
HOLE ENGINEERING SERVICE
5901 FOURTH AVE. DETROIT, MICH.

IDEAL SPEED LATHES
For speedier, more economical finishing of small metal and plastic parts . . .
Finishing • Polishing
Lapping • Burring

Equipped with single or 2-speed motor; exclusive, automatic brake; spring-type hand-operated collet, or step chucks, expanding mandrels.



SCHAUER Speed Lathes



Variable-speed lathe, with infinite selection of spindle speeds, between 65 and 5,000 R.P.M. (ratio of 6 to 1 with single speed and 13 to 1 with 2-speed motor.)

• We design special lathes to meet individual production requirements.
WRITE FOR BULLETIN No. 400

SCHAUER MACHINE CO.
2066-68 Reading Rd. Cincinnati, O.

ADVERTISERS APPEARING IN THIS ISSUE

The

Tool Engineer

Advertising Offices: New York, Chicago, Providence, Detroit, San Francisco, Los Angeles
(see page 3 for addresses)

Abrasive Company 37
Acme Industrial Co. 129
Ajax Steel & Forge Co. 131
Allegheny Ludlum Steel Corp. 96
Allen Mfg. Co., The 113
American Broach & Machine Co. 149
American Chain & Cable Co., Inc. 93
Ames Co., B. C. 141
Ampco Metal, Inc. 142
Anzell Specialty Mfg. Co., Inc. 145
Apex Machine & Tool Co., The 109
Armstrong-Blum Mfg. Co. 115
Armstrong Bros. Tool Co. 135
Arter Grinding Machine Co. 158
Atlas Press Company 150
Axelson Manufacturing Co. 122

Baldor Electric Co. 157
Barber-Colman Co. 12
Barnes Corp., John S. 139
Besly & Co., Chas. H. 30
Bethlehem Steel Corp. 19
Blanchard Machine Co. 90
Blank & Buxton Machinery Co. 148
Boice-Crane Co. 140
Boyar-Schultz Corp. 141
Bradford Machine Tool Co., The 104
Brewster-Squires Co. 145
Brown & Sharpe Mfg. Co. ..... 3rd Cover
Bryant Machinery & Engineering Co. 146

Campbell Division, Andrew C., American Chain & Cable Co., Inc. 93
Carboloy Co., Inc. 11
Carpenter Steel Co., The 88
Cerro de Pasco Copper Corp. 105
Chicago Rawhide Mfg. Co. 139
Chicago Rivet and Machine Co. 126
Chicago Wheel & Mfg. Co. 149
Cincinnati Milling Machine & Cincinnati Grinders, Inc. 116
Cleereman Machine Tool Co. 146
Cleveland Automatic Machine Co., The 4
Colonial Broach Company 89
Columbia Tool Steel Co. 135
Continental Machines, Inc. 95
Crucible Steel Company of America 8, 9
Cullen-Friestedt Co. 137
Cunningham Co., M. E. 123
Cushman Chuck Co., The 144

Danly Machine Specialties, Inc. 124
Davis Boring Tool Division 92
Delta Mfg. Co. 22
Detroit Power Screwdriver Co. 115
Detroit Stamping Co. 147
DeWalt Products Corp. 120
Drive-All Mfg. Co. 39
Dumore Company 138
Duro Metal Products Co. 36

Eclipse Counterbore Co. 149
Enterprise Machine Parts Corp. 156
Etco Tool Co. 135
Evans Flexible Reamer Co. 145
Everede Tool Co. 153

Famco Machine Company 153
Federal Products Corp. 162
Firth-Sterling Steel Co. 15
Fray Machine Tool Co. 125
Frick-Gallagher Mfg. Co., The 127

Gammons-Holman Co., The 125
Garrison Machine Co. 157
Giern & Anholtt Tool Co., Inc. 129
Gisholt Machine Co. 10
Glenzer Co., The J. C. 105
Greenfield Tap & Die Corp. 42
Grobet File Corp. of America 155

Hanna Engineering Works 100
Hannifin Mfg. Co. 40
Hardinge Brothers, Inc. ..... 1st Cover
Hartford Special Machinery Co., The 139
Haskins Co., R. G. 137
Haynes-Stellite Co. 28
Henry & Wright Mfg. Co., The 152
Hole Engineering Service 159
Holo-Krome Screw Corp. 2

Ideal Commutator Dresser Co. 143
Illinois Tool Works 17
Independent Pneumatic Tool Company 21
International Nickel Co., Inc. 74
Ives Engineering Laboratories 155

Jarvis Co., The Chas. L. 128
Johnson Gas Appliance Co. 143
Jones & Lamson Machine Co. 14

Kearney & Trecker Corp. 23
Kent-Owens Machine Co. 101
Knight Machinery Co., W. B. 108
Koebel Diamond Tool Co. 155

Landis Tool Co. 32
LaSalle Designing Co. 159
LeBlond Machine Tool Co., The R. K. ..... 4th Cover
Lee Co., K. O. 123
Lewthwaite Machine Co., T. H. 155
Lincoln Park Tool & Gage Co. 99
Logansport Machine Inc. 16
Lovejoy Tool Co. 136
Lufkin Rule Co., The 153

McCrosky Tool Corp. 112
McKenna Metals Co. 127
Mid-West Tool & Mfg. Co. 130
Modern Collet & Machine Co. 157
Mohr Lino-Saw Co. 155
Moline Tool Company 134
Monarch Steel Company 154
Morey Machinery Co., Inc. 107, 159

National Acme 106
National Tool Salvage Co. 157
National Twist Drill & Tool Co. 145
Nielsen, Inc. 133
Norton Company 6, 7

Ohio Units 103
Oilgear Company 25
OK Tool Co., The 109
Oster Mfg. Company, The 147
Ott Machinery Sales, Inc. 139

Paramount Products Co. 141
Parker-Kalon Corp. 118, 119
Pease Co., G. F. 33
Pereny Pottery & Equipment Co. 153
Pioneer Engineering & Mfg. Co. 93
Potter & Johnston Machine Co. 29
Pratt & Whitney Div. ..... 2nd Cover
Precunier Safety Chuck Co. 125
Putnam Tool Co. 127

Racine Tool & Machine Co. 97
Ready Tool Company 129
Rivett Lathe & Grinder, Inc. 87
Rotor Tool Company, The 35
Ruthman Machinery Co., The 157

Schauer Machine Co. 159
Scully-Jones & Co. 26
Sellers & Co., Inc., W. M. 27
Seneca Falls Machine Co. 31
Severance Tool Mfg. Co. 151
Shakeproof Lock Washer Co. 18
Sheldon Machine Co., Inc. 153
Skilsaw, Inc. 132
Smit & Co., Inc., Anton 102
Smit & Sons, Inc., J. K. 133
South Bend Lathe Works 20
Standard Gage Co., Inc. 1
Standard Shop Equipment Co. 133
Starrett Co., The L. S. 84
Stokerunit Corp. 91
Strippit Corporation, The 151
Stuart Oil Co., Ltd., D. A., The 86
Sundstrand Machine Tool Co. 5
Sunnen Products Co. 34
Swartz Tool Products Co., Inc. 107

Tannewitz Works, The 114
Thompson, Henry G. & Sons Co. 131
Tungsten Electric Corp. 113

Union Carbide & Carbon Corp. 28
Universal Engineering Co. 105, 131
United States Drill Head Co. 155
United States Tool Company 38

Van Norman Machine Tool Co. 82, 83
Vascoloy-Ramet Corp. 13
Victor Machinery Exchange, Inc. 161
Vinco Corp. 137

Walker-Turner Company, Inc. 98
Warner & Swasey Co. 77
Wedin Co., I. T. 157
Weldon Roberts Rubber Co. 141
Whistler & Sons, Inc., S. B. 143
Wilson Mechanical Instrument Co., Inc. 137

Zeh & Hahnemann Co. 143
Ziegler Tool Co., W. M. 123

Please mention "The Tool Engineer"
to advertisers when making inquiries

VICTOR'S BARGAINS IN TUNGSTEN CARBIDE TIPPED TOOLS

Price $1.00 Each In Any Size

NEW LOW PRICES — INCREASE PRODUCTION — CUT OPERATING COSTS

Tools are tipped with Tungsten Carbide, and are suitable for machining cast-iron, brass, bronze, aluminum, non-ferrous materials (such as hard rubber, bakelite, fibre), and tough alloy steels up to 500 Brinell hardness.

Left—100 Series

Left Hand-Reverse Image, Right Hand Shown

Tool No. RH	LH	Shank Size
R-100	L-100	1/4 x 1/4 x 2
R-101	L-102	5/16 x 5/16 x 2 1/4
R-103	L-104	3/8 x 3/8 x 2 1/2
R-105	L-106	7/16 x 7/16 x 3
R-107	L-108	1/2 x 1/2 x 3 1/2

Below—300 Series

Tool No.	Shank Size
300	1/4 x 1/4 x 2
301	5/16 x 5/16 x 2 1/2
302	3/8 x 3/8 x 2 1/2
303	1/2 x 1/2 x 3 1/2

Right—200 Series

Tool No.	Shank Size
200	1/4 x 1/4 x 2
201	5/16 x 5/16 x 2 1/4
202	3/8 x 3/8 x 2 1/2
203	7/16 x 7/16 x 3
204	1/2 x 1/2 x 3 1/2

STANDARD TUNGSTEN CARBIDE TIPPED TOOL BITS

In lots of 12 assorted in any Series; 100-200-300 Series an extra 10% will be allowed; also in lot of 50 assorted 20% discount will be allowed.

Sizes not listed as well as special TIPPED TOOLS will be quoted upon request. When ordering, state tool number and quantity desired.

We Carry Silicon Carbide Emery Wheels for Grinding Tungsten Carbide Tool Bits

SEND FOR OUR NEW 1941 GENERAL CATALOGUE

Victor Machinery Exchange, Inc.

251 CENTER STREET **NEW YORK, N. Y.**

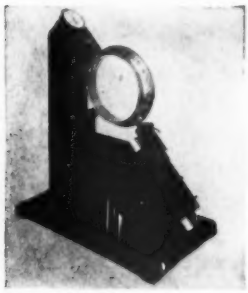
. . . IF it's GAGES You Want

HERE ARE TIME SAVERS YOU SHOULD KNOW ABOUT

• 5 to 10 Times *Faster* •
AND MUCH MORE — CERTAIN INSPECTION

A small Snap Gage. Has adjustable anvil and back stop.

Large diameter Snap Gage with fixed or adjustable diameters. Very light and faster than old style gages.



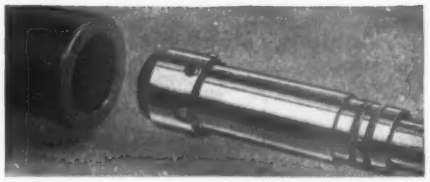
Pitch Diameter Gage for large diameters. Sensitive, accurate and adjustable.

Eight very efficient models selected from a *great* many different Federal gages — hundreds in fact — which Defense Work is using 24 hours a day to speed production.

We can't list all of them here, but ask us what we have.

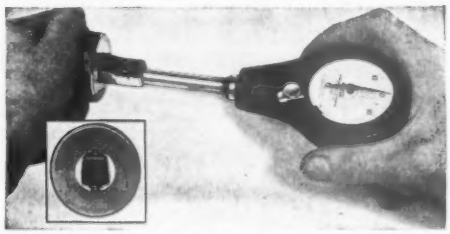
FEDERAL PRODUCTS CORPORATION
Providence Rhode Island

A Snap Gage that checks 3 diameters simultaneously. Extra fast, sensitive and accurate.



Measuring end of a Gun Bore Gage for "lands" and "grooves." Smooth working, sensitive and accurate. "Repeats" faithfully.

Plug Gage; reads in .00005" and finer. Interchangeable size units for diameter and length.



Model 1201 P Small Hole Gage. Very sensitive and accurate, no lost motion in gaging units, self-centering.

Model 149 P for inside dimensions. Model 49 for outside dimensions.

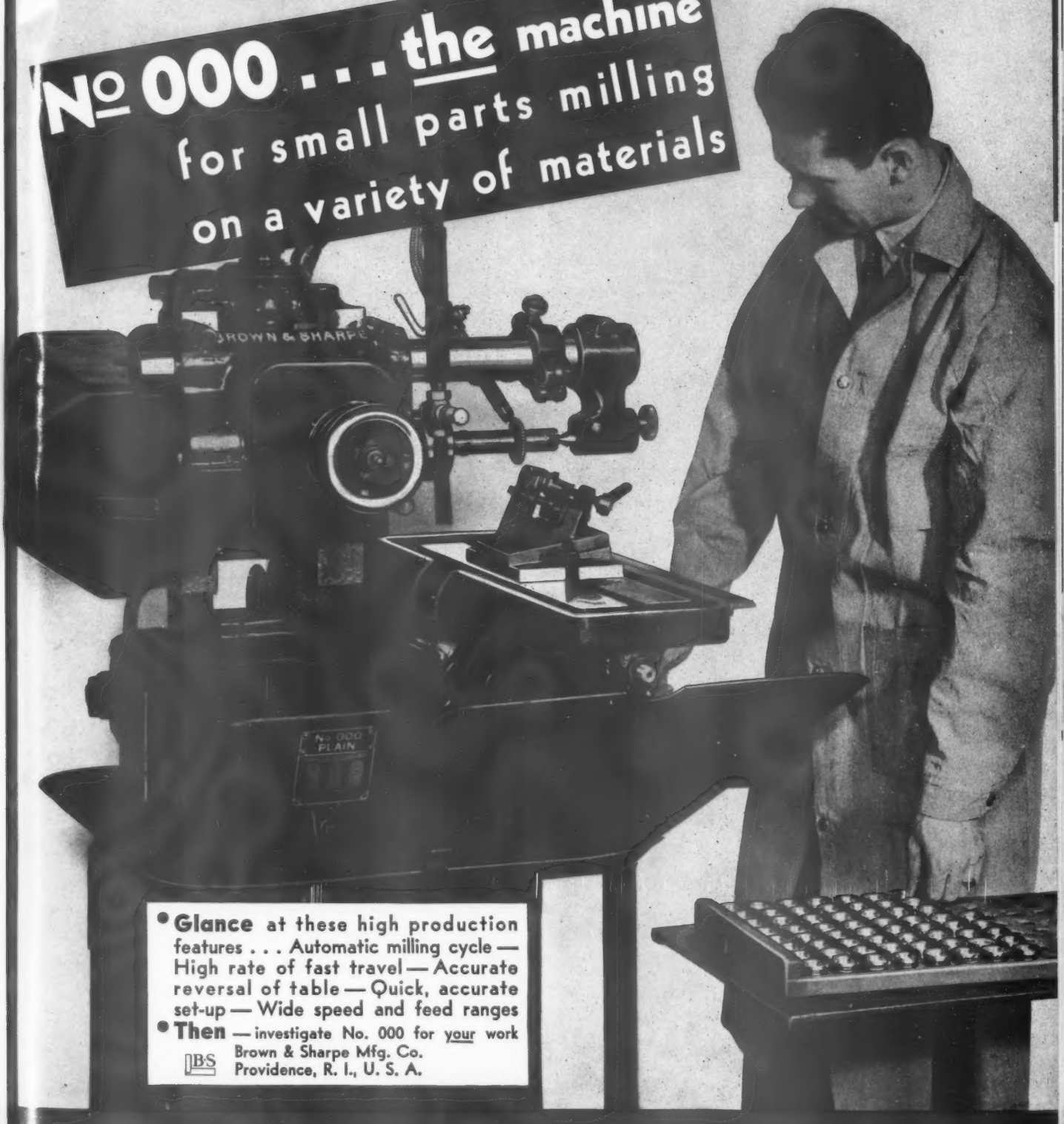
FEDERAL

PRECISION MEASURING INSTRUMENTS

Chicago • Cleveland • Detroit • Hartford • Muncie
New York • Philadelphia • Pittsburgh • Rochester

–YOUR ALLY IN DEFENSE WORK

No 000 . . . the machine for small parts milling on a variety of materials



- **Glance** at these high production features . . . Automatic milling cycle — High rate of fast travel — Accurate reversal of table — Quick, accurate set-up — Wide speed and feed ranges
- **Then** — investigate No. 000 for your work

Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

BROWN & SHARPE

YES SIR–LeBLOND MACHINE TOOLS ARE GETTIN' EASIER TO OPERATE EVERYDAY!

And here's why: Simplified design. Take th LeBlond 16" Heavy Duty, for example. Just two lever on the headstock (1) control the 12, 16, or 27 selectiv speeds. A flick of the wrist and the speed is changed the motor running at full speed meanwhile.

The one-piece, double wall apron (2), an exclusiv LeBlond feature, is simplicity itself. It is operate with a single lever to control the longitudinal feed o the carriage and the cross feed of the tool slide.

The feed box (3) is another example of LeBlond engi neering. From 54 to 63 definite threads can be cu when coupled to the lead screw. When coupled to th feed rod, the same number of feeds can be trans mitted to the longitudinal movement of the carriage or the cross movement of the tool slide.

THE R. K. LeBLOND MACHINE TOOL CO

CINCINNATI, OHIO

CHICAGO
20 N. Wacker Drive
STA 5561

NEW YORK
103 Lafayette Stree
Canal 6-5281